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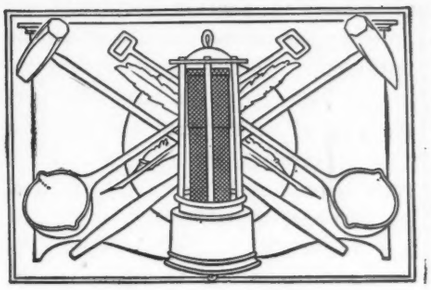

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Illustrated.

The Unit of Measurement for Gold Ore on the Rand

In the JOURNAL of April 25 last, a suggestion to change the unit for ore upon the Rand from the ton to the square fathom was mentioned. This proposal, as originally brought forward by Hugh Marriott, was accompanied by suggestions for other alterations in the statements of working cost and profit; but from these the question of the unit must be considered as distinct, since they could be applied to either unit. Before proceeding to the consideration of the main question it would be, however, as well to state those other suggestions which were as follows: (1) That it would be well to include all expenses as working costs, except those incurred for increase in the production plant; (2) That there should be an actual statement of the gold contents of the ore reserves; (3) That gold brought in from the gold reserve, or gold extracted from accumulated material should be kept separate from that currently obtained from the ore, so as to avoid such anomalies as 100 per cent. extraction; (4) That it would be easier to keep the required regularity of returns if the results were published quarterly instead of monthly.

It will be granted that all these points can be secured with either unit and the question remains, clearcut and defined, whether the ton or the square fathom on the surface plane is the better unit in which to describe the condition of the mine, the progress of the work, and the energy and intelligence of the employees.

It is evident that the ore, when once broken, cannot be trammed, hoisted and treated in the reduction works in terms of a unit of area. The energy and efficiency of the work performed in those operations can only be measured in units of weight, such as the ton; and the chemical treatment is also regulated by practical proportions of weight.

It is for the orebody, however, that the best results are claimed from the use of this fathom unit. It is stated that it would give a clearer picture of the ore reserves and that it would automatically induce great speed in development, closer mining and a higher degree of sorting, all of which would make for greater benefit.

Dealing first with the claim that it would present a clearer picture of the value of ore reserves, it has to be said that those reserves have in any case to be adjusted to the working cost of the previous year, and it would appear to be quite immaterial what unit or divisor be used to determine the working cost, as long as all of the costs are entered and as long as the method of working has not been altered nor the idea of successful working varied. It may be imagined that because a mine holds its property in terms of horizontal area, that its progress is more harmoniously figured in areas; but what is known as the "reef" plane is not comparable to the horizontal plane of the property's extent. It varies in dip, it is disturbed by faults and dikes, and there are variations in the lode width which cannot be expressed in terms of a continuous lode plane. The claim, then, that the fathom unit presents a clearer picture of the value of the ore reserves is not readily conceded.

With regard to the claim that it would induce greater profit, it is agreed that latterly so much credit has been given to low working costs per ton that the total profit has in more than one case suffered, where a leader in the hanging-wall or the footwall has been broken, together with the intervening waste, yielding an increased tonnage of ore at a lower cost. In such cases the attention has been so centered upon the low working cost that the fall in grade—inevitable because of the impossibility of sorting out sufficient of the waste—has not been properly noticed. The mistake, however, was in the attention paid to the low working cost and was not inherent in the ton unit itself; were the attention in a similar manner directed to the working cost calculated to the fathom unit, there would be again a liability to misdirection of effort because there would be no inducement to take more lode than would come in the most easily broken stope.

These considerations lead back to the natural basis of every industrial undertaking; i.e., to the profit made, and every unit and every conception of successful working must be judged by the prominence at which it places the importance of securing a high total profit.

It must here be presumed that the reduction works in general upon the Rand have been erected upon such proper and sufficient data that it must be considered out of the question to shut down a portion of any plant; and that, therefore, this question has to be considered under the condition that the reduction works are to be run fully and to the best advantage. Under such a condition, which unit would foster the attainment of the greatest profit? Should the criterion of successful working be the maintenance of a satisfactory profit per ton, or should it be expressed in terms of the square fathom on the lode plane? If the profit per ton were the consideration, even to the extent of advancing it, there would be every inducement to mine cleanly and to sort closely and at the same time to give to the better lode the earlier attention it deserves; a policy which was very soundly advocated by W. Fischer Wilkinson in a paper read before the Institution of Mining and Metallurgy, April 22, 1909. But would there be any inducement to go outside the better and main portion of a lode to take other leaders or small veins which might produce additional ore, payable, but of lower value? There is no doubt that this would be a question to be considered very carefully, because in taking those outside leaders there would be a greater chance of decreasing than of increasing the profit per ton unless the closest sorting were done. Considering, however, that the main portion of the lode would pay the cost of development and that the cost of breaking the leaders into the opening once made would be less than the first cost of making that opening, it may be said that there would be considerable inducement to take any ore, which, upon investigation, offered a reasonable profit; which inducement would be hightened by the necessity of keeping large reduction works fully supplied. It may be deduced, therefore, that having the profit per ton of ore in view there would be every inducement to mine clearly and sort closely, nor need there be any fear that insufficient attention would be paid to the leaders in the walls. It does not appear that the question of greatest total profit per square fathom on the lode plane, could succeed in doing more than this; and seeing that such a unit would be at variance with practice in other countries, and that, if adopted, it could not be followed through the reduction works, there appears to be no advantage in giving up the old unit and no necessity for so doing.

It may be remarked, however, that the square fathom unit is one which has been long in use underground on the Rand as the basis for all stoping contracts. The contractor is instructed as to what width he must break and the price of the contract is set accordingly, and though there is always difficulty in satisfying the contractor when surveying the work done, yet there is no doubt that at this particular point the square fathom is a more convenient unit than the ton.

It is doubtless the case that the idea of extending this unit has sprung from the realization of the error to which the exaggerated importance granted to low cost per ton was leading, i.e., the error of breaking too much waste, because low cost per square fathom could only be obtained by narrow and clean mining. However, as has been indicated in the above considerations, the same effect is obtained more simply and rationally by giving first consideration to the profit per ton.

To correct any impression that there has been any sustained departure from the best practice on the Rand, it is well to state that from the commencement of work on this goldfield to the end of 1909 the average profit distributed per ton has been about 10s., from which figure the variation, year by year, has been unimportant; the profit for 1909 being nearly 9s. Further, that this maintenance of the dividend rate from ore which was uninterruptedly and materially decreased in value, has been entirely due to reductions in the working cost.

The Latest Steel Corporation Purchase

The option recently taken by the Oliver Iron Company on the 400,000 acres owned by the Michigan Iron and Land Company in the Upper Peninsula of Michigan removes from sale to other purchasers the last large block of ore-bearing lands on the Upper Peninsula of Michigan. Not all of this land carries ore, of course; much of it is valuable only for the timber growing on it, and some of it worth very little. As it consists in great part of the alternate sections originally granted for the construction of a railroad, it includes large areas adjoining known ore deposits and mines actually being worked. There is no doubt that exploration will show an important quantity of iron ore.

The transaction will, therefore, give the Steel Corporation a still stronger hold upon the ore reserves of the Lake Superior region. Further, it will shut out from the Marquette and the Menoninee ranges any independent company which may want to secure a supply of iron ore. In this case the Steel Corporation has followed its established policy of securing reserves of raw material for its own use in the future; and also shutting out possible future competition. Under present conditions, no large steel works can be successfully established without the ownership and control of sufficient iron supplies.

Some of the coal districts in the West —Indiana and Ohio for instance—are making good profits out of the persistent strike in Illinois. They are not leaving all the advantages to West Virginia this time.

CORRESPONDENCE and DISCUSSION

Views, Suggestions and Experiences of Readers

Corbin District, Montana

Mr. Bushnell, in his article on the Corbin district, Montana, published in the JOURNAL of June 4, quotes from my report on a portion of the district, and apparently applies it to a large section of the surrounding country that differs materially from the limited section described by me.

A portion of the report, not quoted, limits the area of softened granite and reads as follows: "The copper-bearing area which includes the lodes of the Butte type is about two miles square. To the north and south of this area the granite is harder and the veins narrower but are copper bearing."

The mines described by Mr. Bushnell are the Boston & Corbin and the Boston & Alta, with brief mention of others. With the exception of the Bird properties, Corbin Metals, and London-Corbin, all are outside of the softened granite area and are either in the hard granite, andesite or diorite, and contain no lodes of the Butte type. It is evident my report cannot apply to them.

The lodes in the soft granite are broad zones composed of alternating bands of quartz and decomposed granite, inclosed between poorly defined walls with cupriferous pyrite as the primary copper mineral and glance enrichments.

The veins in the hard granite are between well defined walls and contain primary chalcopyrite with bornite enrichments, but little or no glance. The Boston & Corbin vein is of this class. The Boston & Alta produced silver-lead ore for years from a vein in the andesite.

The Corbin Copper Company ground is on the diorite. It is not necessary to describe the others mentioned by Mr. Bushnell more than to say they are outside of the softened granite and contain no lodes of the Butte type.

My report was made in 1903 for Arthur Bird and is his property and used by him to interest capital for the development of his ground. A copy of the report was secured by a promoter and used by him as a description of his ground. Since that time it has evidently been common property, and portions of it quoted and distorted by nearly every promoter that had a prospect to sell in that part of Montana.

The original area of three or four square miles has been expanded until it covers 25 sq.m. and embraces everything from a silver-lead vein to a streak of rusty gravel.

Probably Mr. Bushnell has innocently followed the custom of the country and quoted the report as a description of the district, but has unwittingly, I trust, been unfair both to the owner and author of the report in classing mines and prospects of a totally different character from the peculiar "Butte type" lodes described by me.

E. P. JENNINGS.

Salt Lake City, Utah, June 13, 1910.

Commercial Potassium Cyanide

The letter of Ralston Bell, in the JOURNAL of May 21, 1910, takes exception to the view put forward in my communication in the issue of Jan. 15, namely, that when gold or silver dissolves in dilute cyanide solution, the cyanogen and not the alkali metal is concerned in the primary reaction on the precious metal. Possibly the theoretical explanation given in my letter may be at fault. I am certainly not prepared to deny that cyanogen in the gaseous form, i.e., in the molecular condition, as $(CN)_2$, is without action on gold, nor that oxygen plays an important and, indeed, indispensable part in the process. I am also quite prepared to allow that in many reactions potassium shows a stronger affinity for oxygen than sodium. Nevertheless, the following experimental fact remains, which has been repeatedly verified by chemists working in different districts.

Under ordinary working conditions the efficiency of a dilute solution in dissolving gold or silver is the same for any given cyanogen strength, whether the solution be made up with sodium or potassium cyanide or with any of the mixtures of these found in commerce.

Many years ago I made a test in Johannesburg, in which a solution of calcium cyanide was prepared by distilling potassium ferro-cyanide with dilute sulphuric acid and collecting the distillate in lime water. The strength of the solution so obtained was adjusted by adding water until the cyanogen contents (shown by $AgNO_3$ titration) corresponded with those of a known potassium-cyanide solution. Extraction tests made with the two solutions gave practically identical results.

EFFICIENCY OF DIFFERENT BRANDS OF CYANIDE

A test was recently made by myself to determine the relative efficiency and stability of two brands of cyanide, both furnished by a well known firm in New York and marked *A* and *B*. Sample *A* was supposed to contain cyanogen equivalent to 127 per cent. KCN, while *B* was guaranteed equivalent to 98 per cent. KCN.

Solutions in distilled water were prepared from both brands, each titrating 0.203 per cent. CN, equivalent to 0.508 per cent. KCN. An agitation test was made with each solution, using a sand sample, assaying originally $4.40 gold and 3.80 oz. silver per ton, the charge used being: Ore, 300 grams; lime, 1.5 grams; solution, 850 c.c. Agitation in stoppered bottles was continued for 75 hours, and the results are shown in the accompanying table. These correspond

RESULTS WITH CYANIDES OF DIFFERENT STRENGTHS.

Samples.	CN, Per Cent.	KCN, Per Cent.	NaOH, Per Cent.	Assay of Residue.	
				Au.	Ag.
A	0.0958	0.479	0.108	$0.31	1.43 oz.
B	0.0964	0.482	0.099	0.41	1.52 oz.

to an extraction of 93 per cent. of the gold and 62.4 per cent. of the silver for *A*, and 90.7 per cent. of the gold and 60 per cent. of the silver for *B*. Thus, the behavior of the two solutions was identical within ordinary limits of experimental error.

Calculating the cyanide consumption on the basis of equivalent of KCN consumed in each case we have the figures per ton or ore for *A*, 1.64 lb.; and *B*, 1.47 lb. If, however, we base the calculation on the weight of solid cyanide needed to furnish these equivalents, we have, for *A*, 1.29 lb., and *B*, 1.48 lb., showing a decided advantage, weight for weight, in the use of brand *A* (127 per cent. KCN).

SODIUM CYANIDE STABLE IN ALKALINE SOLUTIONS

Another allegation which it seemed desirable to put to the test is that pure sodium cyanide is unstable in solution, owing, perhaps, to the absence of sufficient protective alkali. Solutions of the samples *A* and *B* were accordingly prepared and adjusted so that each had as closely as possible the same volume (about two liters) and the same apparent strength in cyanide. The solutions were freely exposed to the air of the laboratory in open cylinders, merely covered with filter paper to exclude dust.

They probably underwent rather more decomposition under these conditions than would occur on a working scale in ordinary storage tanks. Daily tests of cyanide strength were made by silver-nitrate titration, with the results shown in the accompanying table.

STABILITY OF CYANIDES IN ALKALINE SOLUTIONS.

Date. 1910.	Equivalent of KCN. Solution A, Per Cent.	Solution B, Per Cent.
March 25.....	1.208	1.210
March 26.....	1.206	1.206
March 27.....	1.204	1.206
March 28.....	1.202	1.204
March 29.....	1.196	1.196
March 30.....	1.194	1.196
March 31	1.194	1.196
April 1.....	1.194	1.195
April 4.....	1.178	1.182
May 10.....	1.098	1.120

This test indicates that the more rapid decomposition of the NaCN solution was only appreciable after more than a week's exposure, and even then the difference was so trifling that it may have been accidental.

Results Should Be Reported in Terms of Cyanogen

With regard to the reporting of results in terms of cyanogen, as recommended in my former letter, the system has certain obvious advantages, namely:

(1) The number of cubic centimeters of $AgNO_3$ used is always proportional to the actual amount of cyanogen present, whereas, in a plant where various brands of cyanide may be used from time to time, containing varying proportions of KCN and NaCN, the figures are not proportional to the amount of either of these salts present.

(2) In cases where the kind and amount of alkali metal is unknown, the statement of the result found involves no assumption as to the nature of the alkali metal.

(3) There is no danger of the existence of impurities being masked, as occurs when NaCN is reported as its equivalent in KCN.

In cases where it is thought desirable to convert the cyanogen found into terms of KCN, the calculation which Mr. Bell objects to consists simply in multiplying by 10 and dividing by four. It may be pointed out, moreover, that where the chemist titrates his solution in pounds of cyanide per ton, he does not know at once how many pounds per ton he must add to bring it up to the required strength; unless he also knows the actual cyanide contents of the particular brand of cyanide he is using, and even then a calculation is required.

Sodium-Potassium Determination

With Mr. Bell's remarks on the right of the consumer to know whether he is buying potassium or sodium, I am quite in agreement, and also as to the desirability of having actual determinations made of those metals in the cyanide used. Accordingly, I looked forward with much interest for the account of the promised rapid sodium-potassium determination, and was rather disappointed to find in the JOURNAL of May 28 only a description of the well known method of converting the alkali metals into chlorides and titrating the chlorine. This method may be found in practically every text book[1] of analysis.

This method is known to give sufficiently accurate results only when the two metals are both present in considerable amounts. It cannot be recommended for samples like those marked *A* and *C* in the analyses quoted by Mr. Bell, in which one or the other of the alkalis largely predominates. Probably had Mr. Bell made an estimation of the potassium by some form of the platinum method, and made actual determinations of the carbonates and cyanates, the discrepancies quoted would have been much smaller. In a number of cyanide samples analyzed by the writer at Redjang Lebong, Sumatra, the deficiency was usually less than one per cent., the radicals determined being K, Na, NH_4, CN, CNO, CO_3, Cl, (OH), and moisture. A description of the methods used will be found in my recently published volume.[2]

The occurrence of urea is certainly interesting and may partially explain the mysterious and unaccountable differences between different brands of cyanide. I have once or twice noted the presence of some constituent which has a reducing action on silver nitrate, and thought this might possibly be a formate.

For determining small quantities of potassium in presence of much sodium, I have used Finkener's method, modified by Dittmar and MacArthur. The method appears to be little known, though it can be made to give accurate results without any extraordinary degree of manipulative skill. A brief description of this method appears elsewhere in this issue of the JOURNAL.

Cyanogen Lost in the Determination of Moisture

There is still another point in Mr. Bell's method of analysis which calls for comment. The determination of moisture by fusion or even by drying in a hot-air oven at 100 to 110 deg. C. is liable, with many samples, to give incorrect results as some portion of the cyanogen is lost. A similar loss was also found to occur when samples were dried in a vessel immersed in a water bath, through which a current of air freed from CO_2 was allowed to pass slowly. The only method which could be used in some cases was to expose the pulverized sample in a desiccator containing H_2SO_4 and also an absorbent of CO_2, weighing in a small stoppered bottle until successive weighings showed no variation. The samples tested by the writer frequently gave indications of ammonium salts. A smell of ammonia is sometimes noticed on opening a case of cyanide, showing that these compounds are either originally present in the manufactured article, or are formed by the gradual decomposition of cyanogen compounds.

J. E. CLENNELL.

Torres, Sonora, Mexico., June 11, 1910.

[1] Fresenius, "Quantitative Chemical Analysis," Vol. I (7th ed., 1876), p. 411; Sutton, "Volumetric Analysis," 8th ed., p. 154; Beringer, "Text Book of Assaying," 9th ed., p. 331; Low, "Technical Methods of Ore Analysis," 3d ed., p. 186.

[2] "Cyanide Handbook," McGraw-Hill Book Company, New York.

Mine Ventilation

I have had some inquiries regarding my article, published in the JOURNAL of June 4, 1910, as to where the mine ventilators described were in actual use.

I think that it might be of interest to other readers to know that they are used by: Copper Queen Consolidated Mining Company, Bisbee, Ariz.; Anaconda Copper Mining Company, Butte, Mont.; Detroit Copper Mines Company, Morenci, Ariz., and others. The ventilators are built by the Schutte & Koerting Company, Philadelphia, Penn.

OSKAR NAGEL.

P. O. Box 385, New York,
June 14, 1910.

Copper Losses in Slag

There appear to be two typographical errors in Mr. Sundt's article on "Copper Losses in Slag," in the JOURNAL of May 28, 1910, page 1098. The first formula should be

$$x\frac{p_s}{100} + (90 - x)\frac{p_m}{100} = p_{ch}$$

and the next to the last should be

$$E = \frac{p_m}{10\,p_{ch}} \cdot \frac{9\,p_s - 10\,p_{ch}}{p_m - p_s}.$$

DONALD M. LIDDELL.

Grasseli, Ind., June 11, 1910.

Deposits of molybdenite have been found at Turnback lake in the eastern Abitibi district, northern Ontario about 3 miles from the Grand Trunk Pacific railway. Veins are reported carrying 400 lb. of molybdenite to the ton, with traces of gold. On Kewagama lake, a few miles to the southeast there are seven or eight square miles of granite outcroppings in which this mineral has been found to occur frequently. On the east shore of the lake the granite is cut by quartz veins containing molybdenite in large crystals and it has also been found on the hills back from the lake but in lesser quantities.

Mines Company of America Consolidation

The Mines Company of America, owning gold-silver properties in Sonora, is to be enlarged by the absorption of both the Dolores and El Rayo mining companies in Chihuahua. The absorption will be brought about by an exchange of stock on the basis of 10 shares of Mines Company of America for one share of Dolores, and seven shares of Mines Company stock for one of El Rayo, and in order to bring this about, the capital stock of the Mines Company of America will be increased from $2,000,000 to $9,000,000. The above absorption will take $6,500,000 leaving $500,000 worth of stock in the treasury. It is proposed to increase the par value of the shares from $1 to $10, giving the enlarged company 900,000 shares.

These companies earned for the last 12 months over $900,000 net. The purchase of the La Dura properties on the Yaqui river in Sonora, was made preliminary to the consolidation and the Mines Company, and the Dolores and El Rayo companies each acquired a third interest. The Mines Company and Dolores are largely controlled by capitalists identified with U. S. Steel and U. S. Realty companies, including H. S. Black, John Lambert, I. L. Elwood, William Fleming and William E. Reis, of Raymond, Pynchon & Co., while the El Rayo company is controlled by William B. Thompson and W. Hinckle Smith, of Philadelphia. George A. Schroter will act as consulting engineer.

J. Thomas Reinhardt has issued a protest to the Mines company stockholders advising against the proposed consolidation.

Proprietary Mines Company

During the year in order to open the Valenciana bonanza, the Proprietary Mines Company carried from a depth of 1172 ft. to over 1900 ft., the shaft on the Nueva Luz property at Guanajuato. The sinking of this shaft is subsidized by the Mexican Government. At a depth of 1966 ft, a crosscut is to be run to the vein.

The company purchased machinery for a 250-ton crushing and cyanide plant to be installed in the new mill soon to be completed at the Tajo de Dolores mine at Guanajuato. The mine was bought after examination by Weed & Probert, who reported that the mine should return to the shareholders not less than $270,000 per annum, and that there was 5 years supply of ore in sight, practically all above the fourth level. This report was made last autumn and since then a winze has been carried down in ore practically to the sixth level.

The report of the president at the annual meeting of the company held recently, shows that since last autumn development work has been done on the fifth level and on the upper part of the mine.

The company has also acquired the management of the Yellow Jacket Gold Mining Company and has employed John B. Hastings to take charge. There is a 60-stamp mill near Hailey, Ida., and a large body of gold ore of profitable grade is reported.

Method for Determining Potassium in Sodium Cyanide

By J. E. Clennel

In the examination of commercial cyanides, I have found the following method for determining small amounts of potassium in the presence of sodium as given by Finkener and modified by Dittmar and MacArthur, to give accurate results.

Evaporate about a gram of the sample with sulphuric acid in sufficient quantity to convert all the salts present into sulphates. Redissolve the residue in water and add about 1.25 times the quantity of platinic-chloride solution (i.e., chloroplatinic acid H_2PtCl_6) required to convert the whole of the potassium supposed to be present into K_2PtCl_6; in other words, add 3⅛ parts of platinum for every part of potassium. The amount of platinum needed in this method is much less than in the ordinary (Tatlock's) method, in which not only the potassium, but also the whole of the sodium must be converted into a platinum salt. Warm till the chloro-platinate precipitate just dissolves, adding a little water if necessary. Then evaporate on a water bath to a very small volume and stir to prevent the formation of large crystals.

After cooling, add 10 c.c. absolute alcohol, then after some time, 5 c.c. of ether. Mix well and allow the precipitate (K_2PtCl_6 and Na_2SO_4) to settle thoroughly, say for two hours, under a cover, to avoid undue evaporation. Then decant the liquid through a filter and work with a mixture of one volume of ether and two volumes of alcohol until free from soluble platinum salt.

Precautions in Using Ammonium Chloride

Digest the residue in a cold saturated solution of ammonium chloride, which readily disolves Na_2SO_4, and $MgSO_4$ if present, leaving K_2PtCl_6 undissolved. Collect on a small filter, work as quickly as possible with NH_4Cl solution until free from sulphates, then run alcohol through to remove part of the ammonium chloride.

Dissolve the remaining precipitate in hot water, adding 1 c.c. water for every 5 mg. of platinum present. Transfer to a conical flask of about twice the volume of the liquid. Immerse this flask in a water bath at 80 to 90 deg. C., and lead through it a current of hydrogen gas, purified by passing through a wash bottle containing silver nitrate, until the liquid in the flask is completely discolored. The chloro-platinate is reduced as follows: $K_2PtCl_6 + 2H_2 = 4HCl + 2KCl + Pt$.

As a precaution, CO_2 may be used to displace the hydrogen at the finish. Collect the reduced platinum on a filter, wash with water until free from KCl, ignite and weigh. From the formula, K_2PtCl_6, it is obvious that one atom of Pt corresponds to two atoms of K, hence $Pt \times 0.402 = K$.

No Loss of Platinum

As the platinum is recovered in a pure finely divided metallic form, it is easily reconverted into chloro-platinic acid by digesting with chlorine and HCl in a stoppered bottle. The solution so obtained is then evaporated on a water bath and the residue redissolved to form a solution of known platinum contents. The filtrate containing Na_2PtCl_6 may also be reduced with hydrogen and treated in the same way, so that, with care, there need be no loss of platinum at any stage of the operation.

No Metal Mines in Natal

Natal, mineralogically considered, has been given an unpromising future by Doctor Hatch, who recently completed his report on that colony. During eight months, he examined 70 mines and prospects (excluding coal), taking samples and making surveys and plans where necessary. Graphite, asbestos and phosphates are said to be little worth while. Tin and copper were found only in unpayable quantities and coal was the only mineral which he unqualifiedly admitted exists in quantities. As a guide to other engineers doing similar work, it is of interest to note the expenses of the trip. For the eight months, Doctor Hatch's personal expenses were $14,500 and the expenses of his staff added a further $2900 in addition to $3500 for transportation, assaying, camp equipment and contingencies.

The executive committee of the Independent Oil Producer's Agency at Los Angeles, Cal., is trying to perfect arrangements to secure loans from banks on oil-storage certificates that may be issued by the agency, the latter to repay the loans after the sale of the oil, but in no case to deliver oil to lenders holding certificates. If satisfactory banking arrangements cannot be made, the establishment of a bank by the agency will be considered. It is intended to keep about 10,000,000 barrels.

DETAILS of PRACTICAL MINING

Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

Sorting Table at Cobalt

BY G. C. BATEMAN*

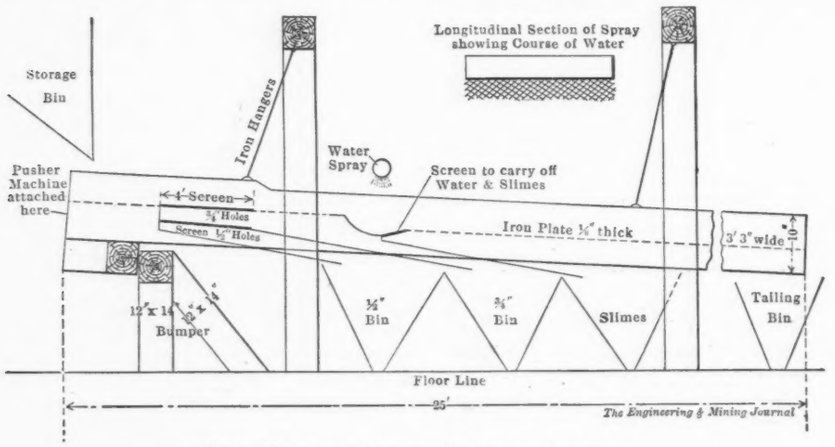
The sorting table illustrated herewith was designed by Hugh Park, manager of the Nipissing mines, Cobalt, to handle a considerable tonnage at low cost and with no preliminary sizing or crushing, and at the same time separate the fines from the coarser material. In almost every mine in the district the fines are sufficiently rich to warrant shipment to a smeltery without concentration.

The table itself is a solidly built affair, 25 ft. long and 3 ft. 3 in. wide, and hung on a slope of 1:25 by iron rods from upright supports. The motive power is a simple little engine on the same principle as the cylinder and piston of a rock drill, and is known as the Park "pusher." This is attached at the head end, and its only function is to pull the table up. At the end of the stroke, which is about 6 in., the air or steam is exhausted and the table falls back by its own weight and strikes against a solidly built bumper, near the upper end.

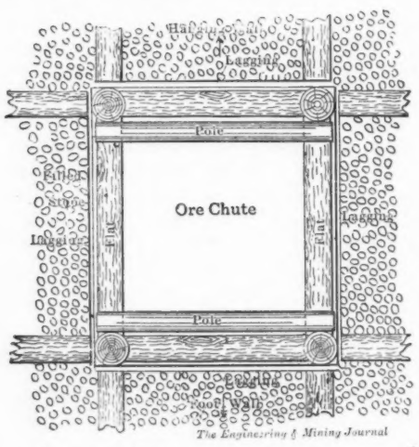
The rock as it comes from the mine is fed from a bin to the upper part of the table, which is covered for its entire length by a steel plate ⅛ in. thick. Just below the feed, there is a screen, 4 ft. long, perforated with ¾-in. holes, which takes off all the fines. Beneath this screen is another, perforated with ½-in. holes, which separates the smaller rock. These screens lead into separate bins. The oversize from the ¾-in. screen passes down the table till it comes to a depression where it is thoroughly washed by a spray. The spray consists of an iron pipe with two rows of small holes, drilled at an angle with the line of the pipe, the angle being opposite for the two rows. This gives a cross spray which thoroughly washes the rock. The water and slimes are carried off, through a screen, to a tank where the slimes are allowed to settle.

As the rock passes down the table from this point, the high-grade and second-class ore are sorted out by hand, while the waste is discharged over the end into a bin. The table bumps about 60 times per min., and when worked to its capacity can handle about 75 tons per day. Usually it takes from five to seven men to do the picking, depending on the richness of the ore. These tables have been in operation at the various shafts of the Nipissing for some time, and are also being used in several other mines.

*Mining engineer, Cobalt, Ont.



SIDE VIEW OF SORTING TABLE AT COBALT



PLAN OF BULKHEADED ORE CHUTE

Bulkheaded Ore Chutes

Ore chutes are carried up through stopes, in many of the mines on the Mother Lode of California, by simply lagging around timber sets. No lining is put inside of the square-set timbers in the chute. This construction serves well enough unless a rock happens to carry away one of the exposed horizontal timbers in the passage way, in which case the light lagging is quickly torn out, letting in waste and often resulting in losing the chute. The lagging may not hold the waste anyhow if the walls are heavy or timber sets swing.

A type of ore chute used in the South Eureka, near Sutter Creek, Cal., is far better for heavy ground and large stopes where the pressure from waste filling is liable to be considerable. The accompanying drawing shows how the chutes are built up. Stull timbers flattened off on two sides like ties, "flats," are first fitted in (across the vein) between the posts. Across the ends of these flats are then laid poles, or round timbers, with their ends extending to the outside of the flats. The poles are set inside of and tangent to the posts. Alternate flats and poles are then laid as the stope progresses. The lagging is not put on until filling commences, as ore can be shoveled between the bulkheading into the chute.

The advantage of this type of chute is in its durability and strengthening effect on the stope timbering. The lining is, of course, strong and wears in most cases as long as the stope lasts. Also broken timbers can be readily replaced without danger of the chute caving. Then too the flats reinforce the posts of the chute set and prevent adjoining sets from swinging. Thus instead of being as usual a weak place in the stope timbering, such a chute acts as a reinforcement.

Barrels as Zinc Boxes

Cheap and efficient vats for the precipitation of gold from cyanide solution with zinc shavings can be made from empty whiskey barrels. These are, unfortunately, only too easy to be had around most mining camps. To make the barrels ready for this use it is only necessary to saw them off about 3 in. from the top and bore a hole for a connecting pipe at a point about an inch below the rim.

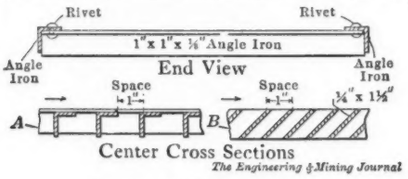
A satisfactory arrangement is to have three lines of barrels arranged so that

the solution is divided and passes through three barrels before being discharged. A screen false bottom should be put in about half way the depth of each barrel. The solution runs off the top of one barrel, passing through an iron pipe, usually 1- or 2-in. diameter, to the next barrel into which the pipe is turned down, terminating just above the screen. Solution passing off the top of this barrel is piped into the next in the same manner. Short zinc and precipitate fall through the screen and accumulate in the bottom of the barrel.

A series of such precipitating barrels are used in the Florence mill, at Goldfield, Nev. It is claimed that three lines of barrels are as efficient as two boxes, each having eight 14-in. compartments. At the Florence mill, the head solution passing to the precipitating barrels assays from $2.80 to $4, the tails only 24c. per ton.

Gold Saving Tables on California Dredges

The problem on a dredge is to recover the gold from a great quantity of gravel and soil in a short time and in a much restricted space. An idea of the quantity of material passing over the gold-saving tables of a modern dredge can be gathered by considering the following figures: The Natoma No. 1 dredge, operating near Folsom, Cal., on the American river, has 13½ cu.ft. buckets, and, if run at full theoretical capacity, would handle 388,800 cu.ft. of gravel per day. The combined area of the gold-saving tables and sluices on this boat is 3840 sq.ft., or, for every square foot of surface, 100 cu.ft. of material would pass through the dredge. Although this figure is exaggerated, as the dredge does not dig continuously throughout the day and all stones over ⅝-in. size are screened out, it is a fact that when the dredge is digging at full speed, 20 of the huge 13½-cu.ft. buckets dump their load into the screen every minute.

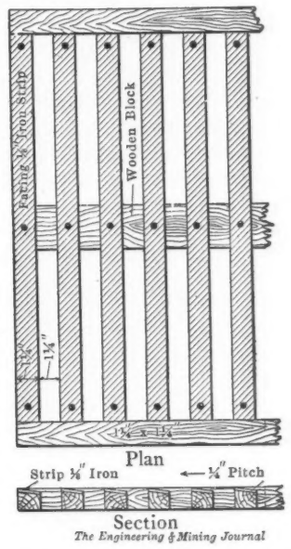


BUILT-UP IRON RIFFLES

HUNGARIAN RIFFLE IN GENERAL USE

Nearly all of the dredges operating in the California dredgefields are using some modification of the Hungarian riffle. The form most popular in California is shown in an accompanying drawing. It is of the usual design made of 1¼x1¼-in. wooden bars spaced at 1¼-in. intervals. Such tables are usually from 2 to 5 ft. wide, and of convenient length for removal and stacking at clean-up time. As shown, blocks are used between the rods to keep them uniformly spaced. The special feature of the design of the riffle shown is in giving the top of each rod a ¼-in. pitch and facing the top with ⅛-in. iron strips. Beveling the top of the riffles minimizes swirling or eddying currents which carry away fine gold, and thus tends to better the gold recovery. The facing on the riffles increases their life.

Another type of Hungarian riffle, which is quite popular on the boats of the Natomas Consolidated of California is similar, but built of 1x1x¼-in. angle irons. The angles are laid crosswise of the tables as in the ordinary wooden type, and are spaced at 1-in. intervals. They are riveted at either end to angles forming the sides of the table. This construction *A* is shown in end view and section in an accompanying drawing of built-up, iron riffles. The cross angles are sometimes set at a slight inclination so as to present a pitched top to reduce swirling and wear, as in the wooden style previously described. In these tables there is more room for "dead" water between the riffles than with those with solid riffles. The recovery is probably slightly bettered on this account. The blocks between the crossbars are unnecessary with this type, so that the area open to settlement is slightly greater than in the other style. A table made of 1x1x¼-in. angles is stiff and may be handled without any particular care.



IRON-FACED HUNGARIAN RIFFLES

IMPROVED IRON TABLES

Still another type of built-up iron table has lately been introduced on some of the Folsom Division boats of the Natomas company by J. H. Miles, superintendent of that division. The cross-section *B* of one of these tables is shown in the drawing. Instead of cross bars of wood or angle iron, strips of ¼x1½-in. iron, set at an inclination as shown are used. The current passes with the upward inclination of the riffles. These are bent at the ends and riveted to side strips, the rivets thus being protected from wear. This is a decided advantage over the angle-iron riffle tables, where rivets holding the cross angles to those along the sides of the tables are placed vertically and exposed to the scouring action of the gravel. When the heads of rivets in the latter construction become worn the tables come apart.

There is a minimum of solid non-effective area to this last type of gold-saving table, the effective area being 80 per cent. greater than with the angle-iron or solid strips. These tables are at present on trial at Natoma. The only other type of gold-saving table in general use in California is that made of expanded metal placed over cocoa matting. The Risdon boats employ this type of table.

American Record in Tunnel Driving

During May, 1910, the Laramie-Poudre tunnel was driven from two headings a distance of 825 ft. The heading from the west end was advanced 332 ft., while the heading from the east portal was advanced a distance of 513 ft., thus breaking all American records for driving a single heading in a calendar month. In January, 1909, the Cripple Creek drainage tunnel was driven 435 ft., and in January, 1908, one of the headings in the Gunnison tunnel made 449 ft., and in October, 1908, the Elizabeth tunnel, near Los Angeles, was driven 466 feet.

TUNNEL THROUGH HARD ROCK

The rock in the Cripple Creek drainage tunnel and in the Laramie tunnel is much the same, being hard, firm granite in each; whereas in the Gunnison and the Elizabeth the rock was very much softer and in the latter quite a large proportion of it was shale. The rock through which the Laramine tunnel is being run is so hard that 27 holes have to be drilled in the face of each heading and loaded with the most powerful modern explosives to break it successfully.

The men work under the bonus system and receive an extra amount of pay for each foot driven over 250 in each calendar month and on such a record-breaking run as that of last month this bonus amounts to quite a sum, consequently both workmen and the contractor, James A. McIlwee, are superlatively happy.

OVAL SHAPED TUNNEL CARRIED

The Laramie tunnel is driven 7 ft. 6 in. high and 9 ft. 6 in. wide and is nearly oval in cross-section thus obviating the necessity of taking out any corners and affording every possible facility

for rapid advance. In fact this was what the consulting engineer of the tunnel, D. W. Brunton, had in view in using this particular section. An advantage was also gained as the undertaking was entirely new and no makeshift machinery had to be employed, so that in designing the big hydroelectric power plant there was nothing to be considered except actual conditions, to which every part of the plant was made to conform.

The rate of driving in the Laramie-Poudre tunnel, as given above, is from the official surveys and measurements of Charles R. Hedke, chief engineer for the Laramie-Poudre Company, so that there can be no question as to the distance driven during the month. Making 513 ft. in a single heading in a calendar month is quite an achievement, but when the difficulties under which the work from the western end is carried on are considered, 332 ft. for that section is almost as creditable.

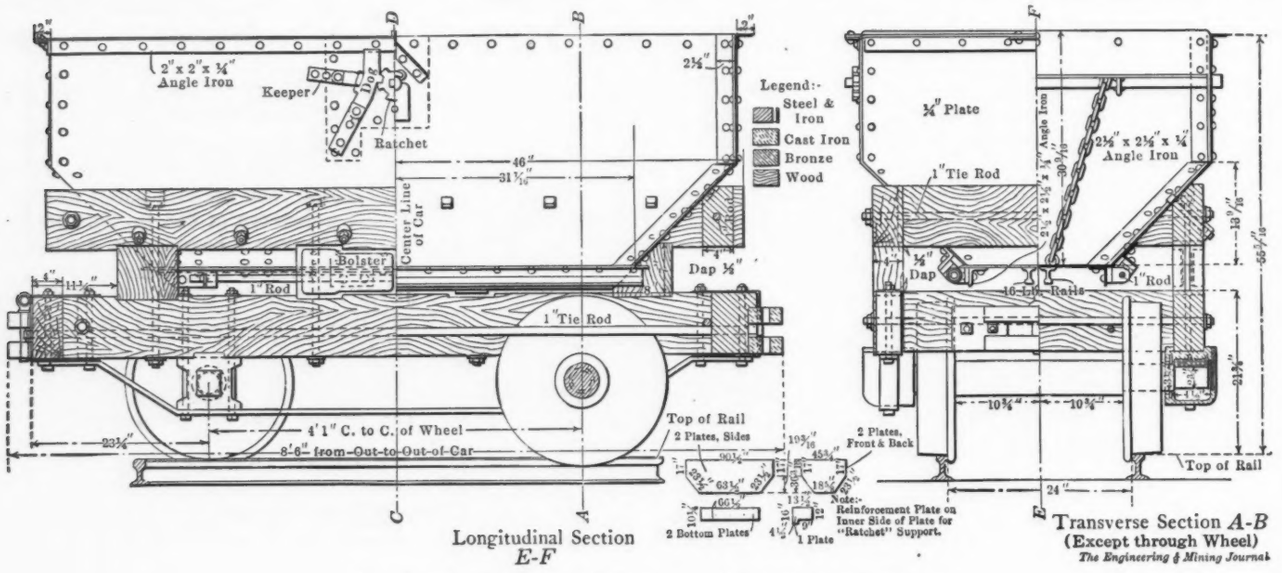
Coeur d' Alene Mine Car

In an accompanying drawing is shown a type of mine car used in the Cœur d'Alene district of Idaho. This particular car is used at the Morning mine, of the Federal Mining and Smelting, at Mullan, and is quite similar to the Bunker Hill & Sullivan cars. The capacity of the car is 68.3 cu.ft., and it is used in the long adit tunnels in which ore from the mine is conveyed to the mill or shipping point. The advantages of this type of car are in its strength and durability, with which is combined simple structural details and rapidity of operation.

The body of the car is made of ¼-in. steel plate, reinforced with angle iron. The patterns of the plates forming the body of the car are shown in the drawing. This body, with sloping bottoms, as shown, rests in a cradle made of 4x8-in. wooden beams set on end, and supported from the axles. The car axles are heavy, being 3½ in. in diameter, turned to 2¾ in. at the bearings. The wheels are 20 in. in diameter, running on a 24-in. track. The overall dimensions of the car are: Width, 51¼ in.; hight, 55 5/16 in.; length, 90½ inches.

The bottom of the body of the car consists of two sections of steel plate hinged along the sides of the sloping bottom of the body of the car. Each flap is weighted along its center with 16-lb. rails and supported by chains from a winding shaft across the body of the car. The car is dumped by simply loosening the ratchet gear controlling this winding shaft. The weight of the ore and the rails on the bottom doors serve to swing them open. A few turns of the winding shaft suffices to close the car again. A handle is used for this purpose and kept at the point at which the cars are to be dumped. One man dumps all the cars of a train.

The winding axle terminates at one end in a ratchet wheel. A dog engages this ratchet and the dog is locked in place by a keeper. The dog and keeper are each pivoted to the body of the car. To dump the car, the keeper is knocked up so as to disengage the dog from the ratchet wheel. The details of this dump mechanism are shown in an accompanying drawing. One man is able to dump 15 cars of this type in about three minutes.



ORE CAR USED IN MAIN TUNNEL OF MORNING MINE, IDAHO

Reporting Concentration Extraction

In the discussion of Walter McDermott's paper on "The Elements of Slime Concentration," W. S. Welton emphasizes the fact that it will be necessary to ascertain what the actual losses in slime concentration amount to under the present conditions. Many managers of mines, he remarks, do not appear to be able to furnish the information; at least, do not publish any statements of the extractions they make, although in the annual reports they make reference to their low labor costs in concentrating work.

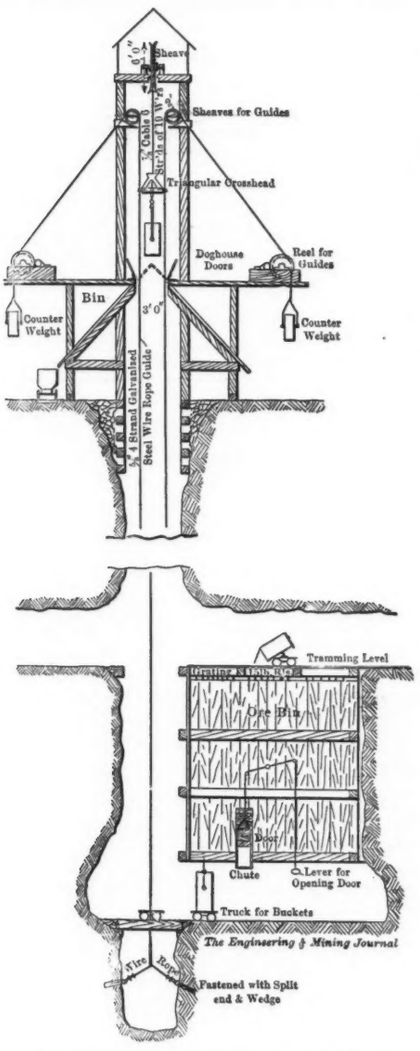
This appears to arise from the circumstance that it has not been customary to publish details of extraction, and consequently the shareholders take no interest in the matter and a manager would therefore get little credit for having increased the returns from his mine by perhaps 10 or more per cent, through improvements in concentration; whereas, if he reduced his labor cost the result would be more apparent. In other words, the inducements held out to increase concentration extractions do not seem so strong as the tendency to improve in other departments where the results may appear in a more spectacular light.

The Laramie tunnel is driven on a grade of 1.7 per cent., sloping from the west toward the east, and consequently the material removed from the west heading has to be hauled upgrade, whereas at the east heading the loaded cars run downgrade and only empty cars have to be hauled up. In addition to this the west-end workings do not run directly out into the open air on grade but are connected with the surface by a 200-ft. incline. This was done to avoid about 1400 ft., of water-bearing rock and wash which, had it been opened up, would have drained directly down the tunnel into the heading. Even with this precaution some water seeps in and has to be pumped. When the difficulties of pumping, uphill haulage, and hoisting through an incline are considered, it will be seen that the 332 ft. driven on the west end is a most creditable performance.

Rapid Hoisting with Wire Guide

By Hugh C. Watson *

A remarkable feat of hoisting is the one now in operation at La Ojuela mine in the State of Durango, Mexico. By means of wire guides and an unbalanced, first-motion hoist, a bucket holding about 1800 lb. of ore is filled, hoisted, dumped and returned to the bottom of a 1700-ft. shaft in 2 min. 10 sec. This is not record time,



Hoisting Arrangement with Wire Guides

but ordinary hoisting speed. It has been done in 2 min. flat.

Advantages of Wire Guides

Wire-rope guides are not the best that can be used, but they have certain advantages which will appeal to some people, especially when working a mine on a prospecting basis, where first cost is one of the essential features. The principal advantages are small cost, ease and speed with which they can be installed and shifted, that they will work in any sort of a vertical shaft, and, considering the speed attained at Ojuela, they are of no mean capacity. The item of six men seems to be an excess of labor, but it does not follow that less men could not be used. The number of men and many of the details will naturally depend upon the kind of mine and the locality.

Of the six men used, one is the hoist man, two are topmen and three are fillers. The topmen do nothing but close the doors, dump the bucket and open the doors for the down trip. Of the three men at the bottom of the shaft, one sits above the ore-bin door with a bar to see that the door does not get stopped up. One stands directly in the shaft to hook and unhook the buckets as they are pushed to him by the third man. The empty bucket is caught on a low truck set to receive it between the guides. The man in the shaft unhooks it from the crosshead, the third man gives his full bucket a push that shoves the empty bucket and its truck to the far side of the shaft, the shaft man then hooks the full bucket to the crosshead and gives the signal to hoist. The bucket now at the bottom is filled while the other bucket is being hoisted and dumped.

Details of Construction

The bucket itself is of the ordinary type attached to the bail slightly below center, and kept upright by means of a link and ear. The doors on the shaft are of the type known locally as "doghouse." They are simply two doors which, when closed, form a gable over the mouth of the shaft on which the ore slides into a bin on either side. The guides are ⅝-in. four-strand, galvanized-steel, wire rope. They are attached at the bottom to a cable that is stretched across the shaft below the track level. This cross cable is anchored on each side of the shaft to a 1½x18-in. eye-bolt, which has a split point and wedge to keep it fixed solidly.

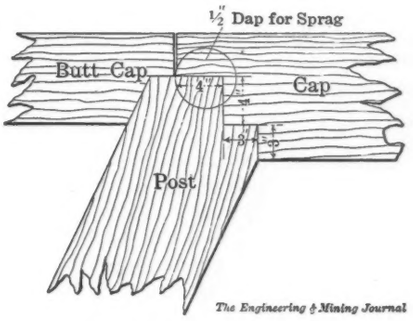
On top, these guides pass over two small sheaves and down to a drum that serves to hold an excess of rope and is also fitted with a counterweight, a crank handle and dog, so that the guides can be easily and rapidly tightened. This is only one of the many ways that these guides can be fastened; in fact, on this same mine there are at the present time seven shafts that have wire guides, and each one has its own system, each taking advantage of something peculiar in that shaft.

The crosshead is made in the shape of a triangle, of 6x6-in. pine, and at the lower side two lead guide blocks are used of such a form as to be easily changed and solidly attached to the triangle. The guides last indefinitely, but the guide blocks have to be constantly replaced. On shaft No. 4, which hoists about 200 tons daily, the guide blocks last four days. When lowering men, four accommodate themselves on the triangle, four stand on the edge of the bucket and two, sometimes three, climb into the bucket. The principal disadvantage of this method of hoisting is that it offers absolutely no way of attaching safety devices, and that it takes a larger shaft for the same size of bucket. The principal advantages, other than those already mentioned, are that no timber is required in the shaft, the system can be used either with the balanced or unbalanced method of hoisting, and that by this method a bucket can be passed through a cave or a big stope, where it would be costly to put timbers. This last is the principal reason for its adoption at Ojuela.

*Mining engineer, Ojuela, Mapimi, Durango, Mex.

Framing for Tunnel Sets

One of the most satisfactory styles of framing tunnel-set timbers is shown in the accompanying sketch. This style is used in the Bunker Hill mine near Ama-



Drift Set for Heavy Ground

dor City, Cal., and also on the Comstock. This style of timbering is equally well adapted for round or squared timbers. The wide notches give a large bearing surface to take up side or vertical pressure, and make this method of timbering admirable for drifts in heavy and swelling ground.

Cost of Assays at the Guanajuato Consolidated Laboratory

The annual report of the Guanajuato Consolidated Mining and Milling Company gives the following figures as the cost of maintaining and operating its assay office: Labor, 5512 pesos; material and supplies, 1203 pesos; crucibles and bone ash, 819 pesos; chemicals, 1905 pesos; charcoal, 1459 pesos; total, 10,899 pesos. During the year, 40,485 determinations were made, of which 25,287 were in connection with the cyanide plant. The average cost per determination was 0.269 peso. This does not include interest or depreciation on the cost of the laboratory and its equipment.

Annual Report on Production of Butte Mining Companies

Under the law of Montana, every person or corporation engaged in mining, must between June 1 and 10, each year, prepare a statement showing number of tons extracted during the year; gross yield or value; actual cost of extracting same from mine; actual cost of transportation to place of reduction or sale; actual cost of reduction or sale, and the net proceeds. This statement must be verified by the oath of the operator, or managing agent of the corporation owning the mine, and must be filed with the county assessor of the county as a basis of taxation. The North Butte, the Red Metal and the several subsidiary companies of the Amalgamated have recently filed their statements which show that the net proceeds from June, 1909, to June, 1910, exceed those of the previous year by $326,090. The accompanying table embodies the reports of nine of the large companies, also the net earnings for 1908 by way of comparison.

REPORT OF BUTTE MINES FOR 1909.

	Anaconda.	Boston & Montana.	Butte & Boston.	North Butte.	Trenton.	Washoe.	Parrott.	Red Metal-Coalition.	Alice.
Tons of ore extracted	1,372,402	1,291,346	377,106	430,124	150,867	203,508	88,416	547,463	1,415
Gross proceeds	$11,158,517	$13,125,554	$3,707,264	$4,217,604	$1,334,224	$1,549,640	$652,093	$4,839,126	$17,320
Cost of mining	5,558,527	4,263,538	1,265,946	1,612,921	649,896	785,728	532,962	2,007,771	20,701
Freight on ore	165,973	813,639	72,669	51,614	18,328	24,516	12,164	101,355	.....
Cost of reduction	2,845,861	3,579,893	948,924	1,798,407	301,692	416,290	180,505	2,034,616	.....
Cost of marketing	1,273,294	1,001,644	380,453	.....	129,214	151,000	74,958	.....	.....
Total cost	9,843,657	10,168,761	2,667,994	3,462,943	1,099,132	1,377,535	800,589	4,143,743	.....
Net earnings (1909)	1,314,860	2,956,792	1,039,270	754,661	235,092	172,105	def. 148,496	695,382	def. 3,381
Net earnings (1908)	2,079,871	1,404,783	646,198	1,839,442	136,898	153,444	def. 12,221	.....	.....

Tennessee Geological Survey

The Tennessee legislature, at its last session, provided for the establishment of a geological survey to begin operations May 1, 1910. The bill provided for a State Geological Commission, composed of the governor, the commissioner of agriculture, the chief mine inspector, the president of the University of Tennessee, the chancellor of Vanderbilt University, and the vice-chancellor of the University of the South. This commission held several meetings, and on March 16 elected, as State geologist, George H. Ashley, formerly of the U. S. Geological Survey, and as associate geologists, L. C. Glenn, of Vanderbilt University, and C. H. Gordon, of the University of Tennessee. The Survey began its work May 1, a temporary office being established in the Capitol Annex building, Nashville.

As the new survey is being deluged with requests for publications, it may be noted that to meet immediate needs the survey plans to publish circulars of information, giving briefly, a summary of the facts already known on the various resources of the State, and giving references to what has been published and how it can be obtained. But the preparation of these circulars will require time. The main publications of the survey will probably appear as bulletins to be issued as fast as work is completed.

Among the things with which the new department will concern itself may be mentioned: Coal, oil, gas, ores, fertilizers, building stones, road-making materials, clays, cement materials, sands, solid minerals and artesian waters, drainage of swamps, streams, and water powers and other natural resources.

Smelting in Bond

WASHINGTON CORRESPONDENCE

The Secretary of the Treasury has at length issued the new regulations governing smelting in bond. At the last moment, however, it was determined not to make known one of the principal matters upon which the department has been bending its energies during the winter—the percentage of wastage at the various plants—but to withhold this as a confidential matter of private business. The suggestion is heard that this determination, which was reached after the strongest representations had been made by the smelting concerns, was desired by them because of a fear that the facts, if made known, would afford ground for discontent because of the high rates of duty on refined metal, in the Payne-Aldrich tariff. It is stated in some quarters that Congress, in one or both Houses, will probably pass a resolution calling for full information from the Secretary of the Treasury with respect to the wastage allowance. Whether this can be done at the current session is, however, extremely doubtful, owing to the fact that adjournment is to occur so much earlier than had been anticipated. The topic will, however, recur next winter.

The text of the general portion of the regulations as now made known shows that the regulations in force under the old tariff for metals other than lead are substantially continued. For ore, and base bullion containing lead, variations have been necessary on account of the requirement of the new law that duty shall be paid on actual weight of lead produced, if it is not exported. Wherever possible the old regulations have been practically continued in force. The important point as to wastage allowance in smelting is to be determined separately in each case.

El Oro Mining and Railway Company, Ltd.

The report of the general manager of the El Oro company for the last six months shows favorable conditions obtaining in all the orebodies. From $8 to $30 ore is being taken from the lowest levels to which the mines have been carried. Exploitation has been going forward in all the orebodies opened, resulting in the development of ore ranging from $5.50 to $30 per ton.

The ventilation shaft made connection with the 1000-ft. level in January and is now down 1558 ft. The Somera incline, and the San Patricio shafts have been carried farther down, the Somera reaching the 1300-ft. level.

On the 100-ft. level of the Descubridora vein, the drift north of the Consuelo shaft ran into stoped ground. The South drift has been extended to a distance of 870 ft., but the last 150 ft. has shown the vein poor. Stoping has been commenced both north and south of the Consuelo shaft, showing the vein to be 2½ to 3 ft. wide, averaging $10 per ton.

The 340-ft. level has been further opened for 450 ft. north of the Providencia shaft, revealing the vein partially stoped, yet disclosing considerable ore of good grade. South of the Consuelo shaft, the drift has been advanced 170 ft. where the ground appears intact. Here the vein is 3 ft. wide, and while the drift at present shows low-grade ore, it is being continued to reach a point underneath the good shoot on the 100-ft. level. The level now has a total length of 1660 ft. Stoping is being carried on north and south of the Providencia shaft over widths running from 2 to 5 ft., yielding ore averaging $10 in gold and in many cases, fair silver contents.

LOWER LEVELS

The 900-ft. level on the Branch vein has been opened to a total length of 500 ft. and shows good results in its southern extension, where $30 ore has been exposed for over a width of 10 ft. In sections "B" and "D" of the 1000-ft. level of this vein, a small amount of stoping has shown the width to increase to 15 ft., with the ore running from $15 to $20, but like the level above, it appears to diminish in width and value as the northern end of section "A" is neared.

In the main San Rafael vein on the 1150-ft. level an overhead drift has been driven for 80 ft., averaging $8 over a width of 5 feet.

In both the Northern and Southern orebodies, new stopes have been opened yielding good returns. Much development work has been done on the Somera claim. The ore runs from $6 to $20 and varies in width from 4 to 18 feet. No. 4 vein in this claim has been opened for a length of 600 feet. showing widths of 5 to 8 fet. It is of good appearance and while the gold contents have continued low, the silver is maintaining its higher average, and this region gives promise of considerable low-grade milling ore.

The report of the secretary for the year ending June 30, 1910, indicates a total profit at the disposal of the directors of approximately £317,798, of which sum the directors propose to expend £234,584 for income tax, improvements, depreciation and dividends. Approximately £83,-214 will be carried forward to the credit of 1910-11. Dividend No. 19 will be posted June 28, declaring 1s. 6d. (0.364c.) per share, free of income tax.

The Utah Copper Railroad

In notifying stockholders of the Utah Copper Company of the proposed bond issue amounting to $2,500,000 for the construction of a railroad between Bingham and Garfield, President C. M. MacNeill said in part:

The work of enlargement is progressing at both the Magna and Arthur plants, which will give to them a total capacity of approximately 18,000 tons of ore per day and provision must be made for transportation.

Prior to the construction of the Magna plant, the company entered into a contract with the Denver & Rio Grande Railroad Company for transporting its ores up to a maximum of 6000 tons per day. The transportation service during a large portion of the time has been so inefficient that it has resulted in largely reduced earnings during frequent and extended periods and Utah directors some time ago determined that it would be unsafe to rely upon the facilities afforded by the railroad to transport the greatly increased tonnage. The capacity of these plants when enlarged will be approximately 12,-000 tons per day in excess of what the Denver & Rio Grande company is under contract to transport.

Bingham & Garfield Railroad to Have Shorter Haul

A railroad corporation has been organized under Utah laws, known as the Bingham & Garfield Railway Company, all the stock of which, save qualifying shares of directors, is owned by the Utah Copper Company. The Bingham & Garfield will issue $2,500,000 six per cent. 10-year sinking-fund gold bonds, payment being guaranteed by the Utah Copper Company. It is proposed to offer the entire issue for subscription at par pro rata to shareholders of Utah Copper Company. The railroad will be 17 miles in length as compared with 28 miles, the present haul.

Mineral Production of California

State mineralogist Lewis E. Aubury has sent to the State printer's office at Sacramento the preliminary statistical mineral returns for California for 1909, exclusive of the gold, silver and platinum figures which are being collected by the United States Census Bureau. Leaving the gold and silver out, the total amount is $61,-324,025. The addition of the precious metals will easily bring the aggregate of mineral production for California, during 1909, up to $80,000,000 and probably more. The advance in the total annual value of mineral production as compared with 1908, will be at least $14,000,000. The statistics of the last three years, including actual returns and also the returns and the rough estimate of the precious metals for 1909, are as follows: 1907, $55,697,949; 1908, $66,363,198; and 1909, $80,000,000. The figures indicate a growth in annual mineral production in the State of California, since 1907, of $25,000,000, which is sufficient to attract wide attention.

CALIFORNIA MINERAL PRODUCTION IN 1909.*

	Quantity.	Value.
Asbestos	65 tons	$6,500
Asphalt	136,664 tons	1,707,159
Bituminous rock.	34,123 tons	116,436
Borax	33,257,000 lb.	1,163,960
Brick	333,846 M.	3,059,929
Cement	3,770,504 bbl.	4,954,210
Chrome	436 tons	5,309
Clay (pottery)	299,424 tons	460,697
Coal	49,389 tons	216,913
Copper	64,841,654 lb.	8,283,202
Fullers earth	459 tons	7,385
Gems	.....	189,040
Granite	358,008 cu.ft.	376,834
Gypsum	30,700 tons	138,176
Infusorial earth	500 tons	3,500
Iron ore	180 tons	174
Lead	2,685,477 lb.	144,897
Pime	520,752 bbl.	577,824
Limestone	337,676 tons	419,921
Macadam	3,567,120 tons	1,636,125
Magnesite	7,942 tons	62,588
Manganese	3 tons	75
Marble	79,600 cu.ft.	238,400
Mineral paint	350 tons	2,325
Mineral water	2,419,834 gal.	462,488
Natural gas	1,147,502 M.cu.ft.	616,447
Paving blocks	4,503 M.	199,803
Pyrites	457,867 tons	1,389,802
Petroleum	58,191,723 bbl.	32,398,187
Quicksilver	16,174 flasks	771,657
Rubble	1,948,658 tons	1,063,809
Salt	124,110 tons	339,671
Sand (glass)	12,259 tons	25,517
Sandstone	79,240 cu.ft.	37,032
Slate	6,961 squares	45,660
Soapstone	33 tons	280
Soda	7,712 tons	11,593
Tungsten	.....	190,500
Total value	.....	$61,324,025

*Precious metals not included.

A great part of the advance of the year 1909 over 1908 may be attributed to the increase in the production and average price of petroleum in California. The same factor was active in causing a great increase in the figures for 1908 as compared with those for 1907, when gold was first distanced by petroleum in value as a product of this State.

The total output of petroleum in 1909 was 58,191,723 barrels, valued at $32,-398,187. This is greater by about $13,-000,000 than the total for gold and silver in the year 1908. California was the first of the States in the Union in 1908 in petroleum production. It is now far in the lead.

The preliminary figures of the State's mineral production for 1909, excluding the precious metals, are given in the accompanying table:

On the Reading of Technical Journals

Dr. Charles Sumner Howe, president of Case School of Applied Science, delivered the commencement address, June 1, 1910, to the graduating class of the School of Mines and Metallurgy, at Rolla, Mo. Among other things he made the following pertinent remarks respecting the use to be made of technical papers:

"The successful engineering graduate will subscribe for the leading technical magazines in his line of work, and he will not only subscribe for them—he will read them, in order that he may keep posted in regard to what men in his profession are doing, not only from the engineering standpoint, but from the manufacturing standpoint as well. Too many technical graduates never take a technical journal. They say they do not need it for the work they are doing, which is probably true, and if they continue in that frame of mind, the probability is, they will never need to take the journals, because they will not rise to positions of high enough responsibility to make it necessary. The successful man—the man who is doing all that is in him to do—must know what other men are doing, and he must put this knowledge to use in the work which he does from day to day.

"I believe every engineering graduate should keep a card catalog of articles and books which he reads, and these cards should give the information under so many different heads that it surely can be found when needed. Almost every man has at some time in his career wanted very much some article which he remembers having read but cannot place. Usually, this occurs to men every week or every day.

"Knowledge is valuable only as it can be used. No one can remember everything which he has read; no one can know all there is to be known; but every engineering graduate should know where to go to find the information necessary in the successful pursuit of his profession. This means knowing how to search encyclopedias, magazines, books, etc., and I think the practice of keeping a card catalog of the important things read will pay for itself many times over. Do not be afraid of a little extra work of this kind."

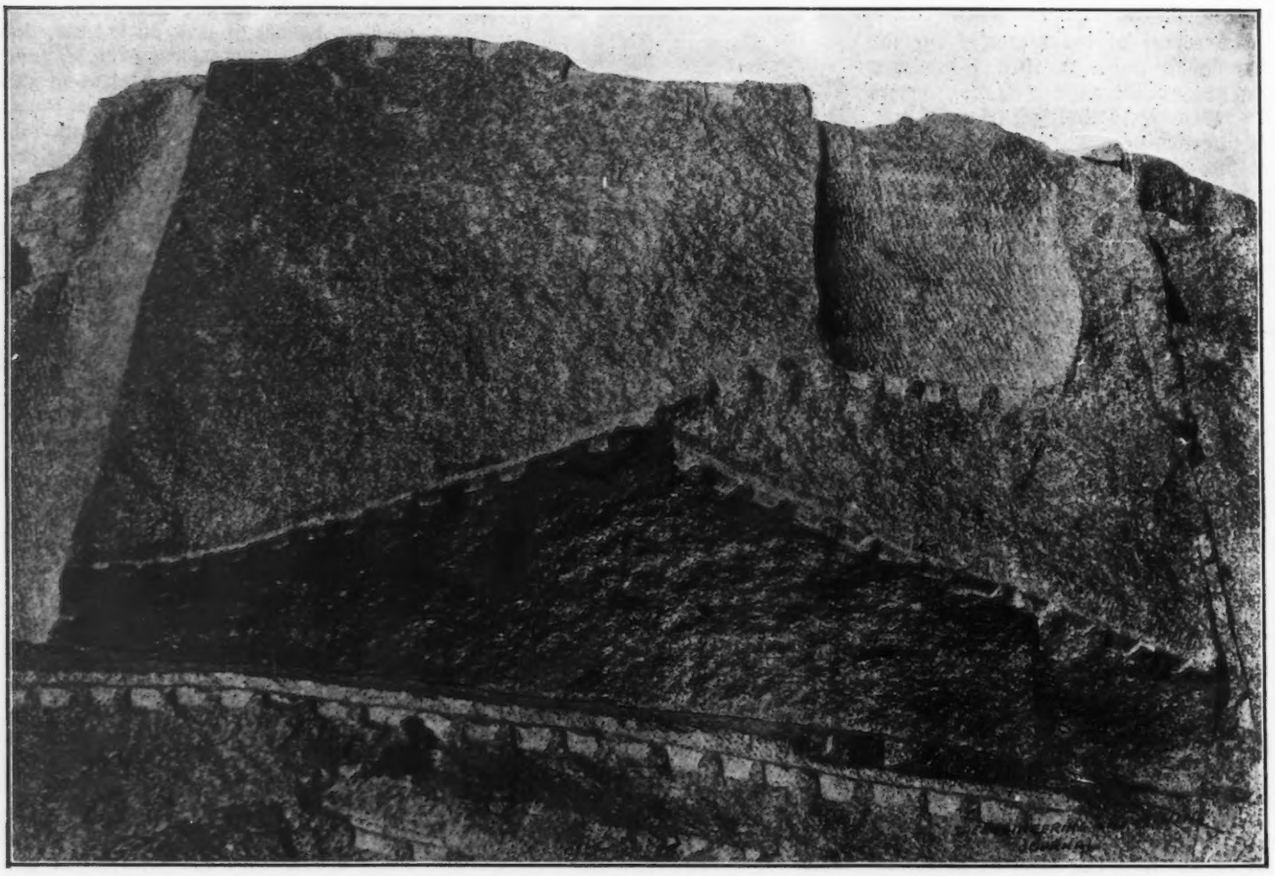
Pharaoh's Granite Quarry

Pharoah's quarry, from which the granite was secured for the pyramids, temples and obelisks, is about one mile from the Nile river, near the great Assouan dam, Egypt. The quarry is approximately 300 ft. higher than the river, and it is from here that immense blocks of granite were transported to the river and then floated down the Nile, nearly 600 miles, to be used in the pyramids. The center of these structures is composed of limestone, which was obtained from quarries across the Nile, only a short distance from the pyramids. The granite forms only the outer covering 5 to 10 ft. thick.

The photograph shown here was taken by J. W. Beardsley, of the J. G. White Engineering Company, New York. Mr. Beardsley was chief engineer public works in the Philippines, and later appointed by the United States Government to investigate the irrigation system in Egypt. It was while on this mission that he visited the ancient quarry and secured the data here given. The photograph shows the granite in place in the ancient quarry in which the tool marks have been preserved. The rock has been protected from the erosive effect of the drifting sand during the past centuries by being buried beneath sand banks. There is no frost or rain in this section and as a result the old tool marks show today with remarkable clearness.

A study of these old quarries suggests as a working theory that the old quarry men thoroughly understood the feather and wedge methods of blocking out stone and used it successfully. Another theory held by the historians is that only wooden wedges were used, and that when these were driven in water was poured on them, which caused the wood to swell and thus break the rock.

The drill holes in the lower row, shown in the illustration, are from 6½ to 8 in. long at the top and 2 to 2¼ in. wide. The corresponding dimensions at the bottom are about one inch less. The depth of these holes is 5 to 6 in. All the corners are rounded. It is a probable conjecture that the Egyptians' best metal for tools was bronze, and how they actually quarried and dressed these blocks of hard, red granite, some of which weighed 1000 tons, and transported them, is an interesting query. In placing these blocks in the pyramids, all the faces were dressed so as to make perfect joints. No small interstices were left to be filled with spalls, and there is no evidence of mortar being used. Many of the joints, as they stand today, will not permit the entrance of a thin cardboard.



PHARAOH'S GRANITE QUARRY, NEAR ASSOUAN, EGYPT, IN WHICH TOOL MARKS HAVE BEEN PRESERVED

Tungsten Ore in Washington

The Germania Mining Company, operating tungsten mines in the neighborhood of the old Deer Trail silver mine north of the Spokane Indian reservation in Washington, recovers the wolframite by milling and ships the concentrates to Germany.

The ore is treated satisfactorily in a mill using four jigs, a hydraulic classifier and three tables. The concentrates assay (for the coarser grades of jig product) over 73 per cent tungsten trioxide, while the lowest grades of table concentrates assay a little over 56 per cent. The major portion of the ore is recovered in the form of the high-grade concentrates.

The milling facilities have been largely increased and the company expects an output of 60 tons for the next sixty days. The company reports a ready market for its ores among its German customers from whom it can secure better returns than elsewhere.

At the Angelo mill of the East Rand Proprietary Mines, Ltd., 10 head of stamps are crushing ore through wire screens having only nine openings per square inch.

Copper Converters with Basic Lining

Magnesite Brick Lining Costs Less Than 50c. per Ton of Copper. Large Charges Required. Silicious Ore Used for Flux. Many Patents Ineffective

BY REDICK R. MOORE*

The first proposal to utilize basic linings for converters was made by John Hollway[1] and discussed by Mr. Thomas, the inventor of the basic-steel converting process, in 1879.

Experiments with Basic Lining

The first successful basic lining for converting was used by Knudsen.[2] He devoted his efforts to ore smelting by converting, and subsequently converting the matte formed in the same vessel or another. Keller[3] tried a magnesite-lined shell at the Parrot smeltery in 1890. A number of other metallurgists have made more or less successful attempts regarding which nothing was published. Heywood[4] has given his experience at the Pittsmont works at Butte with the Baggaley pyritic converting furnace, but the particularly valuable use of the apparatus was lost sight of in a multitude of doubtful claims and in badly designed apparatus, apparently built for the purpose of securing patents.

Peirce and Smith Converter

Messrs. Peirce and Smith tried the basic lining at Baltimore, and after a great deal of experimenting made it successful for converting copper mattes and producing blister copper. By improved design and careful operation, they brought the costs of converting by this method well below the costs resulting from the use of acid lining. The design of their converter has been shown by Vail,[5] but I will give a few further details of construction.

The vessel shown in Figs. 2, 4 and 6 without the bracket 20 (p. 564) is the one in use at Garfield and Perth Amboy. It is 23 ft. long and 10 ft. inside diameter. The shell is made of ¾-in. steel plates. It is open at the top and secured with tie rods. The ends are of ¼-in. plates. There are thirty-two 1¼-in. cast-iron tuyeres, each with its separate improved Dyblie valve and flexible hose connection to the air main. It is surrounded by three heavy flange rings which rest on the trunnion wheels. The wheels are set on sliding bases tied together by heavy bolts, so that they may be regulated to always carry their part of the load which may amount to over 100 tons when full of matte.

The circular throat is placed at one end. It is about 40 in. in diameter and extends about 30 in. above the top of the arch. It is made of sheet or cast iron and lined with clay or magnesite brick, according to circumstances. Clay is best when blowing a matte that tends to form accretions in the throat, and magnesite brick when the tendency is to burn out the throat. The latter tendency is usually exhibited by leady copper mattes. Originally all of the converters were designed with two other openings to admit separate charging of matte and silica, while the converter was blowing. This practice has been abandoned. Matte and silicious ore are charged through the throat as in acid-converter practice.

Tap Holes in the Peirce and Smith Converter

There is also an opening in the side opposite the tuyeres for the removal of slag and metal. This opening, called the breast, is closed with clay and magnesite brick. When skimming slag, an opening about 3 in. in diameter is made in the top of the breast, and when pouring copper, the whole breast is removed to allow the pouring of all the copper without turning the converter too far. There is also an opening provided in the end for the admission of an oil burner, and two small openings in the side opposite the tuyeres for the purpose of inspecting them or making temporary repairs. These openings are all kept closed with clay when the converter is in operation. If there is any delay, or for any reason the copper cools down too much to pour, the oil burner is brought into service and the desired temperature maintained. It is also used in heating up a new lining or an old lining after repairs, although a coke fire will answer equally as well.

Converter Lining

Inside the lining the oval opening is about 6 ft. 3 in. high by 7 ft. 3 in. wide by 19 ft. 9 in. long. The lining is made of 9-in. magnesite bricks, except at the tuyeres where 18-in. magnesite brick or slabs are used. The bottom filling, varying from about 13½ in. thick in the middle to about 4 in. thick on the sides, 18 in. below the tuyere level, is made of ordinary firebrick. The magnesite bricks were all laid in dry magnesite powder, except in the vicinity of the tuyeres, where a mixture of magnesia and linseed oil was used, and between each fourth brick a liner of ¼-in. pine or poplar was placed to allow for expansion. These liners were not used with the tuyere brick. The bottom, after heating in a new lining, was seasoned with copper scale at Baltimore and Perth Amboy. At Garfield, blister copper from the other converters was run in and allowed to set. Too much allowance was made for expansion and some of the top bricks dropped and the absorption of copper was large. Pine boards were set in the ends next to the heads, presumably for an expansion cushion. After about three months' use, it was necessary to take out the ends of the converter and the boards were found to be slightly charred, but showed no evidence of any compression.

The Tuyeres

The tuyeres are 2-in. square castings with a head which is held tightly against the shell by a bolt and plate between each pair. A washer or gasket of thick lead is placed between the casting and the shell. There is a flange on the outer end, which is planed and bored to be bolted and fitted snugly to the tuyere valves. The castings are made with 1¼-in. hole cored out and extend through the lining.

Operation of Basic Lined Converters

The operation of basic-lined converters differs only in details from that of acid-lined ones, which has been described by Offerhaus.[6] When heated up and seasoned, an initial charge of four or five ladles of matte (30 to 40 tons) is poured into the converter through the throat in the usual manner; about 6000 lb. of dried silicious ore are added, the blast turned on and the converter turned over until the tuyeres come well below the matte. A light blast pressure (about 5 lb.) is used for two or three minutes until the silica has spread, when the blast is increased to 6000 to 8000 cu.ft. per min., engine displacement. With 2 ft. of matte over the tuyeres this gives a blast pressure of 10 to 12 lb. per square inch.

Blowing is continued 30 to 45 minutes until the silica has been fluxed by the iron oxides. This is tested by punching a small hole through the breast and feeling of the charge with an iron rod or pipe. When the silica has been fluxed

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[1] *Journ.* Soc. Arts, Feb. 14, 1879.
[2] Eng. and Min. Journ., May 12, 1904.
[3] Peters' "Modern Copper Smelting."
[4] Eng. and Min. Journ., Mar. 24, 1906.
[5] Eng. and Min. Journ., Mar. 12, 1910.
[6] Eng. and Min. Journ., Vol. 86, p. 747.

the converter is turned down, and the slag run off in the usual manner. At the same time another ladle of matte is charged. When small specks of matte show in the slag stream, pouring is stopped. Another charge of silicious ore is added and the charge is blown again in the same manner. This is kept up with smaller charges of silicious ore in the later additions, until the converter is filled to within 2 to 4 in. of the tuyeres with "white metal," or even "pimple metal," when the additions of matte and silica are discontinued and the charge blown to copper with or without interruption according to circumstances.

Test Samples

The appearance of the flame is not used at Perth Amboy or Baltimore. Small ladle samples of the metal are taken during the blast to determine the condition of the matte or copper, and the amount of silica necessary to bring the matte to white metal is judged from their appearance and fracture. When blowing for copper with clean copper mattes the finish may be approximated by the appearance of the flame, but with leady and arsenical mattes this is difficult. With care and experience the copper may be brought to any desired "set."

Amount of Bullion Produced

The amount of bullion produced will vary with the amount of accretions on the vessel, how nearly full it was when the final blow started, and the grade of the metal when "high." Straight copper matte can generally be blown from white metal to copper without stoppage.

With leady copper mattes and a baghouse connected, it was generally necessary to stop blowing every 30 minutes and add cold matte to keep the temperature down, as otherwise the tuyeres would be rapidly burned off and the magnesite in the vicinity of the tuyeres eroded. The temperature may also be decreased by reducing the volume of the blast and, conversely, increased by an increase in the volume of the blast, or by adding matte from the furnace settlers.

Character of Slag

The slag formed has the same general character as the converter slag from the acid-lined vessels, except that it is generally lower in silica to avoid the necessity of using so much silicious ore and resmelting an extra amount of slag in the furnaces. As the greater part of the slag is taken off before the matte is high it is generally lower in copper than acid-lining slags. Attempts to run slags very low in silica were disastrous in that magnetic oxide of iron, in excess of the amount that the slag would carry, was made and formed accretions in the vessel, which rapidly reduced its capacity. Attempts to smelt these accretions out by running the converters hot, and with a more silicious slag, generally resulted in burning out the tuyeres. As many as 19 additions of silicious ore were made to one charge and the slags produced varied considerably in silica contents.

Slag Low in Silica

A slag with less than 25 per cent. silica, when blowing copper matte, is likely to cause accretions. It was generally carried at about 27 per cent. for the average of the charges on that class of matte. When converting leady copper mattes, owing to the high atomic weight of the lead oxide formed and the higher temperatures prevailing, the silica in the slag could be safely carried as low as 20 per cent. and an average in the fluxing charges of 23 per cent. was maintained.

Attempts to run the converter cooler, and thus save the tuyeres, were unsuccessful, as the FeO was formed below its temperature of combination with silica and it was further oxidized to Fe_3O_4 and formed accretions.

Character of Lining

From the foregoing it should be clear that a great deal of care is necessary to obtain satisfactory and profitable life of lining. There is enough latitude between the point of no slag formation and serious destruction of the lining and tuyeres to afford an ample margin for working the process. When operated properly, there is not much corrosion of the magnesite brick, except within about one foot above and below the tuyeres. The tuyeres and brick may be replaced ordinarily at a cost of $250 to $350, with a shutdown of four to six days, of which two or three days are required for cooling the converter so men can work inside. As the tuyeres lasted during the production of 700 to 2800 tons of blister copper per set, the relining cost varied from 50c. to about 12c. per ton.

Silicious Ore Flux

The silicious ore used for fluxing the iron oxides must be dry to give good results. If damp, it tends to form masses that float on the bath and is slow to combine with the iron oxides. Wet material added to hot matte is likely to cause serious explosions. Almost any silicious material or ore may be used if it does not contain too much copper oxide or carbonate, ferric oxides or other compounds that produce highly endothermic reactions in the bath.

As efficient means of drying and handling the silicious ore were not constructed at either plant, the cost of this item was high, amounting in one month to 30c. per ton of blister copper produced. R. Baggaley has patented (U. S. Pat. 895,939, Aug. 11, 1909) a plan for drying and heating ore by the gases from converters which could be readily developed to reduce this cost to about 15c. or less, per ton of copper, and at the same time cut down lost time, waiting for the crane to handle the silicious ore. With two or more converters in operation, the cost would be further reduced, as one man could probably look after three driers as easily as one.

Charging Apparatus

The boats used for charging silicious ore and cold matte were rectangular boxes of sheet iron, reduced to a pouring spout on one end. They were attached to crane blocks for carrying and pouring the contents into the converter through the throat. They held about 7000 lb. of silicious ore.

A 15-ton crane was used at Perth Amboy for handling the matte, copper and silicious ore to and from the converter. Steam locomotives handled the slag and also served the blast furnace.

PARTIAL ANALYSES OF SLAGS AND MATTES.

	SiO_2.	Fe.	Cu.	Pb.
1	26.6	43.2	1.6	....
2	12.8	48.3	10.2	....
3	22.0	43.2	1.6	4.8
4	19.6	42.8	3.0	5.8
5	22.6	38.6	3.0	6.3
6	34.0	36.8	2.8	8.0
7	22.0	34.0	3.7	10.7
8	21.6	30.6	3.2	18.7
9	23.0	21.8	3.7	27.2
10	8.6	15.4 (red)	11.6	39.2
11	8.0	13.4 (red)	27.0	27.2
12	....	....	42.4	12.8
13	....	....	40.5	26.8
14	15.8	17.4	8.6	39.0
15	16.9	6.7 (red)	24.5	34.7
16	9.4	13.2 (red)	24.2	28.8
17	9.8	16.3 (red)	14.8	33.4
18	....	1.0	64.0	11.6
19	....	1.3	62.6	12.8

Notes on Analyses

No. 1—Average slag on straight copper-matte blow; slag magnetic.

No. 2—Specimen of accretion on copper-matte blow; under the magnet, the whole seemed to be magnetite.

Nos. 3 to 9—Slags from converting lead-copper matte. Note gradually increasing lead percentages while copper and silica were held practically uniform. Each represents slag from one blow. At end of seven blows the matte was "white metal" and contained about 64 per cent. copper, 12 per cent. Pb and 1 per cent. Fe. When blown to copper without additions, slag No. 10 was poured off. This red slag is always made with lead-copper mattes, and when containing less than 12 per cent. copper the charge is not overblown. The particular charge for which analyses are shown was finished at "gas copper."

No. 11—Slag foamed out while blowing the white metal from lead-copper matte to blister copper.

No. 12—The average analysis of matte blown on charge with No. 10 slag.

Nos. 13, 14 and 15—These represent leady copper mattes, slag from them when metal was "high," and red slag when overblown to get rid of arsenic

and lead from one charge in a silica-lined converter for comparison.

No. 16—A slag similar to No. 11, formed in the middle of the same period from still another charge which did not foam appreciably.

No. 17—The final red slag from the same charge as No. 16, blown to "set" copper.

Foaming

The amount of slop and splash products was small compared to some acid-lined converter practice, but probably no less than in large acid-lined converters that are operated with equal care.

"Foaming" from overblowing in the first or slag-forming period does not occur in the basic-lined converter with its large body of matte gradually brought up to white metal and the slag poured off at short intervals. There is a similar phenomenon in the second period, which takes place under certain conditions with either class of lining. In the acid-lined vessel, the foaming occurs, so far as I have observed, when the charge is too hot, and is due in some instances to the smelting down of lining and fluxing it by the cupreous oxide formed. The entanglement of copper sulphide in the viscous slag makes it more viscous by the endothermic reaction which takes place between the oxide and sulphide in the mass of the slag. It may also be due to too much slag left on the white metal when "high," or failure to blow until the iron of the matte is oxidized and slagged.

In the basic-lined converter, I have only experienced this foaming when the charge was too cold, although it is said to occur when the charge is too hot if an excess of silica has been added. It can be readily seen that with an excess of silica the same condition and results as in the acid lining would obtain.

Leady Copper Mattes Prone to Foam

The foaming with basic lining when the charge is too cold occurs only, as far as I have observed, in working leady copper mattes. These mattes continue to form slag after the iron is practically all slagged off, and if the temperature is correct, it can be poured off when a considerable amount has accumulated. The silica and part of the iron are probably obtained from wall accretions. In the accompanying table, No. 11 is one of these slags that foamed badly because it was too cold and viscous, and the copper sulphide became entangled and caused the sulphide-oxide reaction. When this occurred, large amounts of slag and white metal were thrown from the mouth of the converter and a strong internal pressure was shown. Nos. 10, 16 and 17 are similar slags formed at the same period, which showed no foaming. Nos. 18 and 19 are lead "white metals" at the beginning of the second period.

The remedy for this foaming was found in not permitting the temperature to get too low. If it should set in, the converter was turned down as quickly as possible and hot matte from the settler added and the blast volume increased. At the same time as much slag as possible was rabbled off. It was always too viscous to run.

Radiation and Conduction of Heat

The basic-lined converter shows greater radiation and conduction heat losses than the acid-lined, on account of its thinner lining and the greater conductivity of magnesia brick. It is, therefore, necessary to work with larger charges or lower-grade mattes, and with higher blast volumes to maintain the same temperatures. The temperatures are generally carried lower than in acid-lined converters. On account of the lower temperature, it is necessary to keep two men punching tuyeres continuously. If punching is stopped for only a few minutes, the blast pressure rises to 18 or 20 lb., and probably higher if left longer.

Loss of Time

There is a great deal of lost time when running only one converter. In blowing matte for the production of 1248 tons of copper bullion, the actual blowing time was about 12½ hours out of the 24, and for the production of 1000 tons of copper bullion from leady mattes, the average blowing time was a little less than 9 hours per day. The rate of copper production was 42 tons per day on copper matte and 35.7 tons on leady matte. The mattes contained about 43 and 40 per cent. copper, respectively.

The enormous amount of lost time is accounted for roughly, as shown in the accompanying table.

TIME LOSS DURING CONVERTING.

	On Copper Matte. Hours.	On Lead Matte. Hours.
Ladling copper	3½	3
Forming initial bath	3	4½
Skimming slag	3	4½
Charging silicious ores, waiting for mattes, etc.	2	2
Charging cold matte and waiting on bag house	...	2½
Total time lost, daily	11½	15

Ladling the copper into a copper-bullion furnace with a five-ton ladle takes about 1½ hours. The three-spout ladle reduces this time to less than one hour. The time lost in securing the initial bath should be reduced by starting to blow with a smaller bath and by increased crane service with larger furnace-settler capacity. Larger furnace capacity with ample settlers would avoid the waiting for matte. The time lost in charging silicious ores and cold matte could be largely eliminated by the use of hoppers set above the mouth of the converter, which could be filled at any time and drawn from as required.

Baghouse waits should be eliminated by efficient gates to the inlets of each section, allowing the gases to be completely shut off from any section while keeping the others in operation.

Basic vs. Acid Lined Converters

The advantages of the basic-lined vessel may be stated as follows: Cheaper construction, as it requires no relining plant; less building space and lighter crane; there is no handling of vessel, hence larger vessels may be used; no clay is used for binder in relining; the use of silicious ores on which there is a smelting margin; less slag is produced, requiring resmelting or special treatment to recover the copper; lower-grade mattes successfully converted at a less cost per ton of matte and silicious ore than the same concentration can be effected in the blast furnaces.

The disadvantages are: Losses due to blowing out fines from the dried silicious ore; lost time while relining and repairing; extra careful manipulation required to avoid premature burning out of lining and tuyeres or the formation of accretions; extra tuyere punching required on account of the lower temperatures necessary.

The cost of relining and drying acid converter shells may, under local conditions, be much less than the cost of repairing the lining and drying the silicious ores. Summing up these advantages and disadvantages, it will be seen that there are many localities where there will be a distinct disadvantage in installing the basic-lined converter, and many where its advantages produce an ultimate plant profit. For example, Anaconda, with clayey pond slimes for a binder and Snow Storm ore for quartz, if operating the converters as carefully as the basic converters have been operated, would probably show no advantage with a basic-lined plant; while Garfield, with barren clays and practically no smelting margin on silicious ores suitable for linings, would find a great gain in using basic linings, even if the acid-lined plant were operated efficiently.

At Aguascalientes there is good silicious ore and cheap labor, but barren clays are being used; the silicious lining would appear to be the cheapest, since the cost of relining is less than the cost of drying silicious ore and replacing tuyeres and magnesia brick.

There are, however, many places where the basic lining will prove advantageous, especially where low-grade mattes are produced.

Basic Converter Patents

The basic converter lining was mentioned by Hollway in his patent (British No. 4549, Nov. 9, 1878), and recent patents along that line have been confined to accessories, tuyeres and the like. R. Baggaley, C. M. Allen and Lindquist

have secured a large number of such patents, none of which seem to cover any essential features of the process or apparatus, although some of the accessories may be valuable under certain conditions.

Peirce and Smith have secured four patents in which they make considerable effort to obtain some returns for the skill which has resulted in the successful application of the basic linings. Smith's (U. S. Pat. 942,675, Dec. 7, 1907) patent leaves out the tuyeres directly below or in range of the outlet port. Such a patent, if valid, is ineffective as it could readily be avoided by putting in the tuyeres and allow them to close, or plug them if desired. The principle is wrong and the slopping action is not decreased by omitting the tuyeres below the outlet.

A better efficiency and lower power costs would be obtained by putting in more tuyeres and keeping them open. Peirce has patented (U. S. Pat. 944,905, Dec. 28, 1909) a telescopic head, to allow for longitudinal expansion in the lining. These heads are used on recent converters, but are useless as there is no evidence of any longitudinal strain. A removable end is useful if accretions are formed; by removing it they can be cut out more readily, but a much less cumbersome device could readily be constructed. Peirce has patented (U. S. Pat. 942,661, Dec. 7, 1909) brackets to hold the lining from shifting. These are not in use. Messrs. Peirce and Smith have patented (U.S. Pat. 942,346) ten claims which I will attempt to criticize.

Peirce and Smith Patent Claims

The first four claims are invalidated by the claims of a coherent, noncorrodible lining. The lining of magnesia brick is not coherent. An examination of the brick, when repairing, will show that the internal faces next the charge have been glazed and united by the slag produced. Where this action has not taken place the brick separate readily. It is not noncorrodible but on the contrary only lasts in the vicinity of the tuyeres for the production of a few hundred tons of copper.

The claim of a flexible tuyere is not tenable when an iron casting fits snugly in two ¾-in. steel plates. Flexible tuyeres are not essential, as shown by the operation of the Baggaley converter at Butte and by the operation of those at Garfield and Perth Amboy. The lead washers or gaskets did not show the slightest evidence of movement of the tuyeres during a period of seven months; and no tuyere was broken from any cause except allowing them to fill with slag and matte and trying to punch or drill them out.

Claim No. 5 is for "metal tuyeres, square in cross-section, flexibly sustained from the shell," etc. I would suggest to make them round and inflexible if the claim is considered valid. Claim No. 6 covers the old device of holding the tuyere in place by a plate bolted to the shell on one side of it and is unquestionably not valid.

In claim No. 7, they add "and having continuous full-delivery connection at the receiving ends with the source of blast supply." I presume this is intended to patent the hole in the tuyere casting. Whatever it may mean it shows nothing new or novel and has no validity.

Claim No. 8 attempts to guard the air blast, during transit through the lining, against diminution of volume by leakage into the body of the lining by metal tuyeres. This was anticipated by Baggaley (U. S. Pat. 865,671) and by the metal tuyeres put in converters by Fraser & Chalmers about 10 years ago.

Claim No. 9 covers the use of a cement, formed of ground magnesite and an oil, for luting in the tuyeres and the brick adjacent to them. Ground magnesite and tar or tar oil have been in use many years and are far superior to the mixture of magnesia and linseed oil, preferred by them. The linseed-oil mixture does not form a permanent cement. When changing tuyeres the magnesia pours out of the holes as a fine sand.

Expansion of Converter

Claim No. 10 covers the opening in the top for allowing the expansion of the body to be taken up by the arch. In view of the reverberatory converters that have been proposed with their arched tops and tie rods, this claim would not appear to add much weight. The arches do rise up and keep rising.

A careful study of the causes led to quite a simple explanation. The rising of the arch is only because it is open to the air, dust and dirt. When the converter is cooled, the slag on the inside cracks. The cracks not coming exactly together, dirt falls in and lifts the roof slightly upon reheating. Also at times there are internal explosions which lift the roof slightly, and naturally it never goes back to its former position. I have seen bricks blown entirely out of the roof by explosions caused by charging icy matte. Again there is, during foaming, a strong internal pressure at times sufficient to lift the 9-in. arch brick. In my opinion a top fastened in by bolts with slotted holes to allow easy removal and replacement would be far preferable.

Credit for Practical Development of Basic Converter

Looking at their claims as carefully as possible and without any bias, I must say that I cannot see that they have invented anything. Messrs. Peirce and Smith are certainly entitled to their full share of the honor due to skill and care with which they have brought the basic-lined converter to a successful issue and they are to be congratulated upon the excellent design of the apparatus.

Comstock Tunnel Company Operations

Under the recently completed contract between the mines on the Comstock lode and the Comstock Pumping Association, more than $465,000 has been expended upon the Comstock Tunnel Company's tunnels and the mining shafts connecting therewith. Ore from the Consolidated Virginia is being shipped through the tunnel and milled in the company's reduction works. The development carried on by the several mines and the Comstock Pumping Association has resulted in the thorough equipment of the mines with modern electric hoists in seven of the deep shafts, new electric pumps of ample capacity at the C. & C. and the Ward shafts.

The Ward shaft is now down 2575 ft., the C. & C. shaft 2600 ft., and the plans already adopted provide for sinking both shafts to the 3000-ft. level. The Mexican mine is down to the 2500-ft. level and is about to begin prospecting in virgin ground at that point. The Gold Hill mines, consisting of the Yellow Jacket, Crown Point and Belcher, under the management of Edward B. Sturges, have been taking out about 4000 tons of low grade ore each month and reducing the same in the Yellow Jacket mill. The plan recently adopted to connect the Ward shaft with the Combination by a drift on the 2450 level should result in the early development of the Potosi, Chollar and other mines at depth by means of the Ward shaft and Combination shaft.

Engineer Hall, of the Comstock Pumping Association, states that the "dead work" upon the Comstock is now nearly accomplished and that rapid development of the deepest levels may now proceed under most favorable conditions. It is claimed that not more than 10 per cent. of the ground below the level of the Sutro tunnel has been prospected. Continued coöperation between the Comstock mines and the Tunnel company now seems assured by reason of the investment in the mines by the larger shareholders of the Tunnel company.

Proposed Building for the Geological Survey

The new public buildings bill just prepared by the House committee on public buildings and grounds contains, in section 27, provision for a fireproof building of modern office-building type to be erected on square No. 143, Washington, D. C., at a cost not exceeding $2,500,000. It is to afford accommodation for the entire organization at Washington of the offices of the Geological Survey, Reclamation Service, Indian Affairs, General Land Office and the Bureau of Mines.

Data on Mortality and Morbidity of Miners—I

Miners Experience Excessive Mortality and Sickness Due Largely to Accidents and the Conditions under Which They Are Forced to Work

BY FREDERICK L. HOFFMAN*

The mortality and morbidity of American miners has never been made the subject of qualified scientific inquiry, primarily for the reason that the necessary data for a conclusive investigation are not extant. The crude mortality statistics of the United States censuses of 1890 and 1900, and of the census report on mortality for 1908, are of limited practical value, since they do not represent the facts for the country as a whole but only for the registration area, in which but a small proportion of the mining industry is carried on. The returns are also quite inapplicable to special considerations, since coal and metal miners are combined, and the group even includes quarrymen, who follow a decidedly different calling.

Shifting Character of Mining Population

The data even for the registration area are also, in all probability, quite defective in that the true number of deaths is not returned, chiefly because of the shifting character of the mining population and the ready opportunities for employment in other industries should an impairment in health or diminished physical strength make such a change appear advisable. Subject to this limitation, however, the census returns for 1900 are of some value in that they permit of the calculation of death rates per 1000 living at specified periods of life, and a fairly trustworthy comparison can therefore be made with the specific death rates for other industries or trades. The census mortality report of 1900 included only the miners and quarrymen in the registration states, reported as having been 38,890, among whom there occurred 373 deaths, equivalent to a death rate of 9.6 per 1000.

Abnormal Age Distribution

This rate, however, is misleading on account of the peculiar age distribution of a mining population in which the age period 25-44 comprises 57.1 per cent. of the total, and ages 65 and over, only 1.5 per cent. The very small proportion of aged miners is brought out in glaring contrast when it is stated that among farmers, planters and farm laborers the proportion arriving at an age of 65 and over in 1900 was 11.5 per cent. The contrast in the mortality is not as great as would be the case if the system of death registration were complete, which is admittedly not the case, and for obvious reasons the defects in death registration would be more serious in the case of a transitory, shifting, or more or less floating population like miners, than in the case of a more permanent population like farmers, planters and farm laborers. Subject to this restriction, however, it is significant that at nearly all ages the death rates of miners are higher than the corresponding death rates of farmers and planters, although the miners, on the whole, represent a physically selected class.

According to the census of 1900 the death rate of farmers and planters at ages 15-24 was 3.7 per 1000, while the corresponding death rate of miners and quarrymen was 5.4; at ages 25-44 the respective death rates were 6.6 and 7.8 per 1000; at ages 45-64 they were 13.2 and 13.1; but at ages 65 and over they were 96.8 for the first and 116.6 for the second of these two groups of occupations. The death rates of miners therefore were excessive throughout life except at ages from 45 to 64 inclusive, and considering the fact that the rate was based upon only 81 deaths actually enumerated, there can be no doubt but that the true mortality of miners and quarrymen at this as well as at every other period of life, was decidedly in excess of that of the agricultural population.

Mortality Higher for Miners than Quarrymen

The foregoing data are, therefore, inconclusive but they practically constitute the sole source of information on this important subject at the present time. No local board of health in any one of our numerous cities or towns in the mining regions has thought it necessary or expedient to make a special inquiry into the vital facts of the men employed in mining operations, although for some of the cities at least the material available would yield important and instructive results. In 1908 the Bureau of the Census for the first time published occupation-mortality statistics, without reference, however, to the living population. For office reasons the miners and quarrymen were again combined into a group, so that the returns are of less value than they would be if the two occupations were separated. It is practically certain that the mortality of quarrymen is lower at all ages than the corresponding mortality of miners, if only for the reason that the accident liability is much higher among miners than among quarrymen, although the dust exposure among the latter is certainly more serious than among coal miners, who

TABLE I. COMPARATIVE FREQUENCY OF DEATHS FROM ACCIDENT AMONG AGRICULTURISTS, AND MINERS AND QUARRYMEN.
(Registration Area of U. S.—Census of 1908.)

Ages.	Poisons, Gases, Etc.		Other Accidental Injuries.	
	Agriculturists.	Miners and Quarrymen.	Agriculturists.	Miners and Quarrymen.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
15–19	0.7	...	25.5	71.8
20–24	0.6	0.2	22.0	64.9
25–34	0.6	0.2	17.4	61.9
35–44	0.9	0.6	14.2	46.8
45–54	0.8	1.8	9.8	27.6
55–64	0.4	0.3	5.7	13.0
65–over	0.2	0.4	3.1	7.1
All ages	0.4	0.6	7.8	38.8

TABLE II. COMPARATIVE MORTALITY OF MINERS FROM ALL CAUSES IN ENGLAND AND WALES—1900-02. (Rate per 1,000.)

Ages.	Coal Miners.	Ironstone Miners.	Copper Miners.	Tin Miners.
15–19	3.20	3.08	.....	1.49
20–24	4.47	3.01	.....	5.53
25–34	4.93	5.34	14.57	13.41
35–44	7.65	6.62	23.08	27.15
45–54	14.67	12.23	19.42	38.75
55–64	35.98	27.97	48.78	72.17
65–over	139.82	98.27	116.40	222.22

*Statistician, Prudential Insurance Company, Newark, N. J.

experience on the whole a mortality from tuberculosis below the average.

Data from 1908 Census Report

While the census data for 1908 are of limited value they are nevertheless suggestive with regard to the specific disease liability from tuberculosis and the frequency of industrial accidents. The relative frequency of disease or accident occurrence may be approximately measured by the percentage of deaths from specified causes in the mortality from all causes at specified periods of life. When this method is applied to the mortality of miners and comparison is made with the corresponding mortality of farmers and planters, which is, of course, an extreme test, but the best possible since this class as a rule experiences a very low mortality, the results are decidedly instructive, particularly with reference to the occurrence of accidents, as shown in Table 1.

Table III. Comparative Mortality of Coal Miners and Men Employed in Agriculture and the Building Trades in England and Wales—1900-02. (Rate per 1000.)

Ages.	Coal Miners.	Agricultural Laborers.	Building Trades.
15–19	3.20	1.94	1.82
20–24	4.47	3.26	3.32
25–34	4.93	3.96	4.77
35–44	7.65	5.70	9.81
45–54	14.67	10.13	17.50
55–64	35.98	19.76	30.72
65–over	139.82	78.26	82.62

It is shown by this table that, combining all accidents, the percentage of deaths from this group of causes is extremely high throughout every period of life for miners and quarrymen, while relatively high among agricultural and farm laborers. Of course, any percentage proportion depends upon the frequency of deaths from other causes, but it is a fair assumption that in the case of miners at least, the excess in the proportionate mortality is the result of an actual excess in the death rate of miners and quarrymen at every period of life.

The table is only included here as a suggestive contribution to the subject of miners' mortality in the United States, since no other information is at present available. It is a matter of sincere regret that the numerous miners' benefit funds should never have given publicity to the facts of their experience, but it is to be hoped that in course of time the results of this experience will become available for general use.

Information from Foreign Sources

In marked contrast to the dearth of definite information regarding the mortality and morbidity, or sick rate, of miners in America, quite an amount of extremely useful and conclusive information is available for England and Wales, for certain states of continental Europe, and for some of the colonies of Australia. By far the most conclusive mortality data are the returns of the registrar-general for England and Wales for the three years ending with 1902. These have been consolidated in Table II, exhibiting the comparative mortality of miners from all causes, with distinction of the mineral or metal mines. It requires to be stated, however, that the actual number of men employed in copper and tin mining in England and Wales is comparatively small, so that the death rates for the different periods of life require to be accepted with some caution, but they are confirmed by other evidence proving conclusively that the mortality is much higher among this class of metal miners than among the corresponding class of coal and iron miners.

TABLE IV. COMPARATIVE MORTALITY OF COAL MINERS IN VARIOUS COALFIELDS OF ENGLAND AND WALES—1900-02. (Rate per 1000.)

Ages.	Whole Area.	Durham and Northumberland.	Lancashire.	West Riding.	Derbyshire and Nottinghamshire.	Staffordshire.	Monmouthshire and South Wales.
15–19	3.20	3.14	3.65	2.85	2.56	2.49	4.03
20–24	4.47	4.88	4.86	3.40	3.79	4.00	5.01
25–34	4.93	4.54	6.01	4.27	3.33	4.16	5.78
35–44	7.65	6.76	9.03	7.48	5.97	6.65	8.94
45–54	14.67	13.79	17.44	13.01	11.25	16.07	15.94
55–64	35.98	31.63	42.41	33.97	31.25	38.00	39.84
65–over	139.82	155.40	136.61	142.19	149.04	163.21	105.30

TABLE V. AGE DISTRIBUTION OF DEATHS FROM COAL MINING ACCIDENTS, BY CAUSES, IN ENGLAND AND WALES—1900-1902. (Ages at Death.)

Cause of Accident.	Under 15	15–19	20–24	25–34	35–44	45–54	55–64	65 and Over.	All Ages.	Per 1000 Accidental Deaths in Coal Mines.
Fall of coal, stone; crushing	28	140	168	318	289	229	111	24	1307	523
Fall in pit or shaft	2	10	14	29	26	14	12	5	112	45
Machinery; boiler explosion	7	20	14	10	10	5	7	2	75	30
Wagon, tram, tub	73	129	63	70	54	45	40	23	497	199
Rope breaking	...	3	2	4	1	1	1	..	12	5
Firedamp	...	17	19	60	37	22	8	1	164	66
Choke-damp; suffocation	1	2	2	...	6	1	...	..	12	5
Drowning	...	...	6	6	6	2	1	..	21	8
Blasting	...	3	6	14	11	11	3	..	48	19
Otherwise, or not stated	11	26	17	49	48	46	32	23	252	100
Total	122	350	311	560	488	376	215	78	2590	1000

It is brought out by this comparison that the mortality of coal miners is higher throughout every period of life, except from 25 to 34 than the corresponding mortality of ironstone miners, who are generally held to be subject to comparatively few health-injurious circumstances affecting their employment. The mortality of copper and tin miners is very much higher at every period of life than the corresponding mortality of coal and ironstone miners, and this fact is fully confirmed by the special report made by order of the secretary of state of the Home Department on the health of Cornish miners, and published as a parliamentary paper in 1904.

Comparison of British Miners and Agriculturists

Without enlarging at this time upon the causes responsible for the excess in mortality, which, of course, is primarily the result of a higher liability to accident, but also in the case of copper and tin miners to an exceedingly high mortality from disease, the following comparison is of interest as showing the death rates of coal miners and agriculturists in England and Wales, and at the same time the corresponding death rate for men employed in building trades. Table III sets forth this matter.

Without exception, the mortality of coal miners is shown to be higher, and at the older ages decidedly in excess of the corresponding death rate of the agricultural population. When, however, the mortality of coal miners is compared with the mortality of men in the building trades, it appears that the mortality is excessive for coal miners at ages from 15 to 34, and 55 and over. Considering the relatively high degree of accident liability in the building trades, and the extreme degree of weather exposure, combined with liability to overstrain and the various other unfavorable circumstances, it is significant that practically throughout life the mortality of coal miners should be higher than the corresponding mortality of men employed in the building trades.

Comparative Mortality in British Coalfields

Still more significant are the mortality returns for the different coal-mining areas of the United Kingdom, and in this con-

nection it is properly observed by the registrar-general in his report upon the occupation mortality of England and Wales for 1900-02, that "in order to determine the mortality experienced by coal miners in different parts of the country, the figures relating to six representative areas have been separately examined." And while in comparison with the previous period a decline in the death rate equivalent to 21 per cent., was shown to have taken place in all the coalfields, against a decrease of only 16 per cent. for occupied males generally, in the Durham and Northumberland coalfields the decline amounted to only 15 per cent., in Lancashire to 19 per cent., while in Derbyshire and Nottinghamshire it was 20 per cent.; in West Riding it was 25 per cent. and in Monmouthshire and South Wales, 28 per cent. Table IV shows the respective death rates by periods of life for each of the English coalfields for the three years ending with 1902, the rates being per 1000 of employees living at the ages stated in the first column. The variations in the death rate are fully set forth by this table, and do not require further explanation.

The differences in the rates suggest probable differences in the local accident liability, but also in the probable variation in disease liability according to more or less unsatisfactory conditions of underground mining, and perhaps the qualitative and quantitative differences in the dust exposure. The table emphasizes the great practical value of differentiating the mortality of miners in different coalfields, since important departures from the normal are invariably obscured in the aggregates for the coal-mining area as a whole.

Variations in the Local Death Rate

While it is not the purpose of this discussion to emphasize the underlying causes of variations in the local death rate, Table V is included as exceptionally instructive, since no corresponding data are available for the United States. The table shows for England and Wales the age distribution of deaths from mining accidents, according to causes, for the three years ending with 1902, and redistributed in the last column upon the basis of 1000 accidental deaths.

Among the suggestive results of this analysis is the item of fatal accidents due to underground haulage, chiefly run-over accidents to mere children at ages under 20, numbering 202 out of a total of 497, or 40.6 per cent. Since the number living at specified periods of life is known, it would be possible to calculate the exact death rate for every cause and every period of life. This is not possible for any coal-mining area of America at the present time.

Manchester Unity's Morbidity Statistics

It requires no further statistical data to sustain the conclusion that at every period of life the mortality rate of coal and metal miners is excessive. Even more important is morbidity which entails an enormous economic burden upon the mining population and the various agencies organized to mitigate the economic consequences of temporary or permanent disability resulting from sickness, accident, or both. For the United States no information of this character is available, but fortunately a wealth of information on the subject has been published by the foremost English friendly society, the Manchester Unity of the Independent Order of Oddfellows Friendly Society. This society made a new investigation of its mortality and morbidity experiences for the five years ending with 1897, and throughout the most skilled actuarial and other expert ability was employed to place the results of the investigation beyond the possibility of a doubt as to their accuracy or validity.

Since it is primarily the purpose of a friendly society to furnish financial aid in the event of sickness or disability resulting from accident, the results of this investigation are chiefly valuable in so far as they have to do with the sickness branch of the society's operations. Without, therefore, enlarging upon the mortality experience of the society, I only include Table VI, showing the comparative mortality of miners and other classes of workmen in the experience of the Manchester Unity for the period 1893-97. The figures show only the relative mortality as calculated upon the standard expectation, which represents the experience of the order for a previous period. The table shows throughout a mortality below the expected at ages under 45, and for all classes except miners at ages 45 to 64, while at ages 65 and over the actual mortality was above the expected for all the various groups of employments considered.

TABLE VI. COMPARATIVE MORTALITY OF MINERS AND OTHER CLASSES OF WORKMEN, EXPERIENCE OF THE MANCHESTER UNITY, 1893-97.
(Percentage of Actual Deaths to Standard Expectation.)

Ages.	Agriculturists and General.	Outdoor Building Trades, Railways and Navigation.	Quarrying, Iron and Steel, Chemical and Allied Employments.	Miners.
16–44	64	73	72	70
45–64	88	95	95	108
65–over	104	106	123	134

Miners Considered as Separate Group

It should be stated in this connection that the agricultural group of employments includes certain general occupations not subject to special hazards or exposure. The outdoor building trades, railway and navigation groups, include employments which, upon thorough inquiry, were found to have more or less similar death and sickness rates in the society's experience. The same principle was applied in quarrying, iron and steel, chemical and allied employments with heavy labor, while miners were considered separate and distinct from the others.

According to the table the mortality experience of miners at ages under 45 was relatively quite favorable, while it was 8 per cent. in excess of the expected at ages 45-64, although other and similar occupations had a mortality below the expected. Finally at ages 65 and over, the excess in the mortality for miners was 34 per cent, against an excess of only 4 per cent. for agricultural and general laborers, 6 per cent. for the outdoor labor class, and 23 per cent. for men engaged in heavy labor, particularly quarrying, iron and steel work, chemical work, etc. It is, therefore, shown that the experience with miners was on the whole decidedly less satisfactory than the corresponding experience with other classes of labor.

TABLE VII. COMPARATIVE SICKNESS EXPERIENCE OF MANCHESTER UNITY—1893-97.

Ages.	Agricultural and General.	Whole Society.	Outdoor Building, Railways and Navigation.	Quarrying and Iron and Steel (heavy labor).	Mining.
	Weeks.	Weeks.	Weeks.	Weeks.	Weeks.
16–24	100	112	116	152	183
25–34	100	110	119	149	189
35–44	100	111	125	148	193
45–54	100	109	124	132	190
55–64	100	107	122	137	182
65–74	100	105	119	136	164

Comparative Sickness High for Miners

Even more suggestive and conclusive are the results of the sickness experience as emphasized in the quantity of sickness in selected occupation groups and in the whole society, in comparison with 100 weeks of sickness experienced by the agricultural and general labor classes. Table VII exhibits all the neces-

sary details, and shows conclusively that at every period of life the amount of sickness among the mining element was considerably in excess of the corresponding amount of sickness in the other labor groups and for the society as a whole.

To avoid a possible misinterpretation of the table, it may be stated again that the figures are only relative, and show, for illustration, that at ages 16-24, of every 100 weeks of sickness among the agricultural and general labor classes, there were 183 weeks of sickness among the mining class, equivalent to an excess in the amount of sickness of 83 per cent. At ages 25-34, the excess in sickness for the mining class was 89 per cent.; at 35-44 it was 93 per cent.; at 45-54 it was 90 per cent.; at 55-64 it was 82 per cent.; and at 65-74 it was 64 per cent.

(To be concluded)

Exploring the Chibogamau Country*

The Chibogamau region is the most interesting district in the northern part of Quebec, and is believed by many to be an eastern extension of the mineral belt which includes the Cobalt district in Ontario; but so far it has been only partially explored. Excepting the early explorations made in 1674 by the Jesuit Father Albanel, the first report of importance was that by James Richardson, who examined the district geologically in 1870. Richardson mentions the existence of a zone of chloritic schists, diorite, serpentine, conglomerates and granite strongly mineralized in places with iron and copper pyrites and magnetite.

Reports of Various Observers

These observations were subsequently confirmed by A. P. Low, who was in the region in 1885 and who also called attention to the similarity of the rocks to those of the Sudbury district. He states in his report that there are important indications of economic minerals. In 1897, H. O'Sullivan, in a report on the country between the Lake St. John and James Bay, mentions that on the portage between lake Chibogamau and lake Wacounipi he noticed a compass variation of 166 deg., caused by some deposit of magnetic iron in the neighborhood. Peter MacKenzie, in 1903, undertook an exploration of the region, from which he brought back good specimens of asbestos and of copper ores. This was followed in 1904, 1905, 1906, 1907 by further explorations by Messrs. Obalski, Low, MacKenzie, Machin and Dulieux, with further confirmation of the presence of areas of Huronian rocks and of indications of strong mineralization.

Owing, however, to the lack of transportation, the development of the mineral deposits is handicapped, and the Quebec Government has been strongly urged to take steps to remedy this, either by building a railway into the region, or by granting subsidies toward the construction. But the information about the region is far from specific. It is the result of explorations on broad lines, and it is not sufficiently detailed to warrant at present the large expenditure required for the building of a railroad. Before taking action in the matter, the Quebec government has decided to send a commission of geologists and engineers to report on the possibilities of the region.

Personnel of Party

Three commissioners have been appointed: Dr. A. E. Barlow, J. C. Gwillim, and E. R. Faribault. The high standing of these three men is a guarantee that the report of the commission will be as authoritative and unprejudiced as possible.

The party will be composed of the three commissioners, each with a technical assistant, and of Mr. Valiquette, of the Bureau of Mines, who will have charge of a topographical and geological party under the direction of the commissioners. Mr. Valiquette will also act as mining recorder, to issue miners' certificates, mining licenses, and to record claims, etc., for any prospectors who may now be in the region. There will be 10 or 12 canoemen and laborers

The party will leave Roberval on Lake St. John as soon as the state of the rivers will permit, probably about the middle of June. The route will be by wagon to Portage à l'Ourse, 25 miles; then by water along the Chamouchouan, Chigobich and Nikoban rivers and following a chain of small streams and lakes over the Height of Land to Lake Obatagamau, the starting point of the work. This will require about 180 miles of travel by canoe, with numerous portages.

The Proposed Railroad

The railroad, if built, would extend from Roberval, the terminus of the Quebec & Lake St. John road, northwest about 200 miles. It would run through a country as yet almost wholly uninhabited, the most northerly settlement being St. Felicien du Nord, 20 miles from Roberval. The country is rough and heavily timbered, and has many small lakes and rivers. A large development of water power is possible on some of the streams.

The area to be explored is an irregular parallelogram north of the Height of Land and including Lakes Obatagamau, Doré, Chibogamau, Oremiska, Rush, Asitchinibastat and Wahwanchi Its northern side is not many miles south of the large Lake Mistassini. Mr. Obalski, who made the most extensive reconnoissance in the region, reported indications of gold, silver, copper and asbestos.

*Abstract of an article in *Canadian Mining Journal*, June 1.

Nova Scotia Steel and Coal Company

This company owns coal lands and mines in Pictou county and Cape Breton, Nova Scotia; iron-ore mines in Nova Scotia and on Wabana island, Newfoundland; blast furnaces, steel works and rolling mills at New Glasgow, in Nova Scotia. Its report for the year 1909 shows total capital liabilities of $6,000,000 common, $1,030,000 preferred and $1,000,000 debenture stock; $3,500,000 bonds. The common stock was increased by $1,000,000 during the year. The debenture stock was also issued and sold, and the bonds were issued, retiring all the old bonded debt.

The income account for the year can be stated as below:

Net earnings for the year	$799,978
Government bounties	107,971
Total	$907,949
Interest, depreciation, etc.	$647,963
Dividends	142,400
Total payments	$790,363
Surplus	$117,586
Balance from 1908	1,219,221
Total	$1,336,807
Dividend 20 per cent. in stock	1,000,000
Net surplus forward	$336,807

The ordinary dividends were 8 per cent., or $82,400, on preferred, and 1 per cent., or $60,000, on common stock. The sales and receipts were $2,069,737 for iron and steel products and $3,408,108 for coal, ore, etc.; total, $5,477,845. Prices on all products were lower than in 1908; and there was a decrease in the government bounties. Advances were made in coal-mining wages.

The mining statement shows that 809,341 tons of coal were mined from the Sydney mines, and 87,515 tons of coke were made. Iron ore shipped from the Wabana mines was 460,387 tons. Limestone and dolomite quarried, 74,407 tons. Pig iron made was 58,676 tons; steel ingots, 64,240 tons; steel billets rolled, 52,931 tons. Finished products included 45,090 tons bars and plates rolled, and 27,705 tons car axles forged. Total shipments from works were 12,402 tons pig iron and 58,575 tons finished steel.

The sum of $362,653 was expended during the year on capital account in the development of the submarine iron-ore areas at Wabana and for improvements elsewhere.

The development of submarine iron-ore areas at Wabana was continued, the main slope being extended through the areas a further distance of 1470 ft. The slope is now about 1650 ft. into these areas from their southern boundary. The development work carried on has fully confirmed the estimates previously made as to the quantity of ore contained in and the great value of these areas. The plant for the operation of these submarine mines is now being installed.

The Giroux Shaft at Kimberly, Nevada

Five Compartment Shaft Constructed by Raising from 1000 ft. Level; Cost $71.21 per Foot. Progress 5.27ft. per Day. Stope Drills Used

BY C. EVERARD ARNOLD*

The Giroux Consoliated Mines Company is equipping a five-compartment shaft at Kimberly, Nev., which will serve the Alpha mine. The depth of this shaft, January, 1910, is 963 ft., and of this depth, 948 ft. was opened by raising; 15 ft. of sinking was done so that the bearers, collar set, and three shaft sets might be installed and concreted, and with this done it was possible to erect the necessary surface equipment for resuming shaft timbering on the completion of the raise. The arrangement of the shaft timbering is shown in Fig. 1.

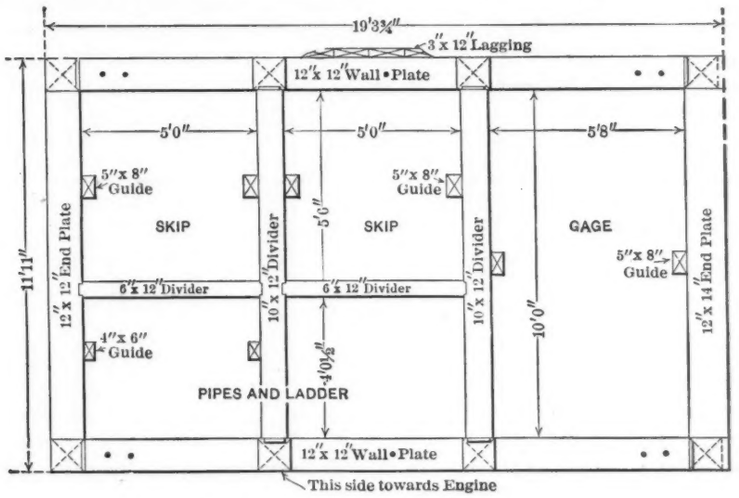


FIG. 1. PLAN OF SHAFT TIMBERING

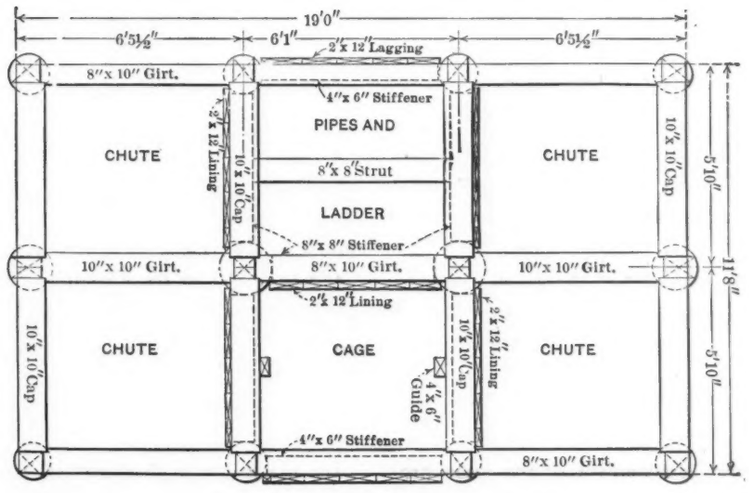


FIG. 2. PLAN OF RAISE TIMBERS

ARRANGEMENT OF SHAFT COMPARTMENTS

At the 1000-ft. level of the Alpha, and 750 ft. southwest from the Alpha shaft a 14x18-ft. station was cut, and a 25-h.p. air hoist was installed. From here the raising commenced on July 5, 1909. The raise was cut approximately 13x21 ft. in area, and supported by timbering with square sets, illustrated in Fig. 2, which shows the division into seven compartments. The end compartments, which were used as chutes, had the center girts heavier than in the others on account of the wear from falling rock. The chute lining was braced by inserting 8x8-in. stiffeners parallel to and half way between successive caps. Silimarly, the lagging on the wall sides of the cageway and the compartment for pipes and ladder was stiffened with 4x6-in. timbers. In the pipe and ladder compartment the chute stiffeners were reinforced with 8x8-in. struts, and as the cageway was partitioned off by braced lining, there was practically no chance of rock entering the ladderway in case a chute burst into the cageway.

HANDLING OF BROKEN ROCK

Over the central compartments the last two sets were always bulkheaded with 8x12-in. timbers, shown in Fig. 3, and from the lower bulkhead the cage sheave wheel was suspended. After a round of holes had been blasted and the loose ground picked down, the average time required to hoist, plumb, and block a set of timbers was two hours, although the operation was occasionally performed in one hour 30 minutes.

When possible, the chutes were kept almost full in order to minimize the chances of injury in case men should happen to fall. For the purpose of protecting the lower timbers of the chute, breakers or platforms of 10x10-in. timber were spiked to the girts, at intervals of seven sets. On these breakers the rock piled up and formed its own slope. Trouble was often caused by large rocks dropping into the chute, and on reaching the gate, these rocks would have to be drilled and blasted before they could pass through.

STOPING DRILLS USED

The drilling was done entirely with Waugh stopers, No. 8 C, and these machines proved remarkably satisfactory. Three were used for raising the entire distance, one being kept in reserve in case of accident to the others, although all three machines were used on the last 75 ft. of the raise. Each machine wore out one chuck and one tappet, and beyond replacing these, no repairs were required.

The shaft is wholly in limestone, and for the greater part the ground was favorable for fast raising. Normally, on blasting a round of 36 holes seven feet deep there would be room for a set of timbers and the back would support itself well. Sometimes the ground was so shattered by intersecting slips that only half the round could be blasted with safety. This procedure made room for half the set, which was then blocked before the remaining holes were blasted

NOTE—From *Bull.* A. I. M. E., June, 1910.
*Kimberly, Nev.

and the set completed. At one or two spots the ground encountered could be removed with a pick, and in these cases each post was placed as soon as there was room for it. At 125 ft. from the surface there was a small patch of ground so hard that two rounds of 40 holes were blasted before a set could be placed.

VENTILATION

Excellent ventilation was maintained by using two Roots pressure blowers, size No. 1, running in tandem. One was placed at the foot of the raise, drawing the foul air through an 8-in. air pipe and delivering through an 8-in. air pipe and a 6-in. pump column to the other blower, which was above ground.

After the 1000-ft. and 770-ft. levels of the Alpha were connected, the raise was served entirely from the latter level. Three shifts were worked continuously, and 180 days were required to complete the raise, the rate of advance being 5.27 ft. per day, or 158 ft. per month.

The progress per month was: July, 167; August, 150; September, 133; October, 143; November, 165; December, 190; total, 948 ft. The total cost of the raise was $67,509, which is at the rate of $71.21 per foot, distributed as shown in the accompanying table.

COST OF RAISING.

		Cost Per Foot.
Labor	Raising	$16.69
	Tramming	5.09
	Timber framing	1.76
Blacksmithing		1.19
Machine shop		0.11
Teaming		0.54
Air compressor		10.00
Supplies		17.24
Hoisting		15.15
Proportion of general underground expense		3.44
Total		$71.21

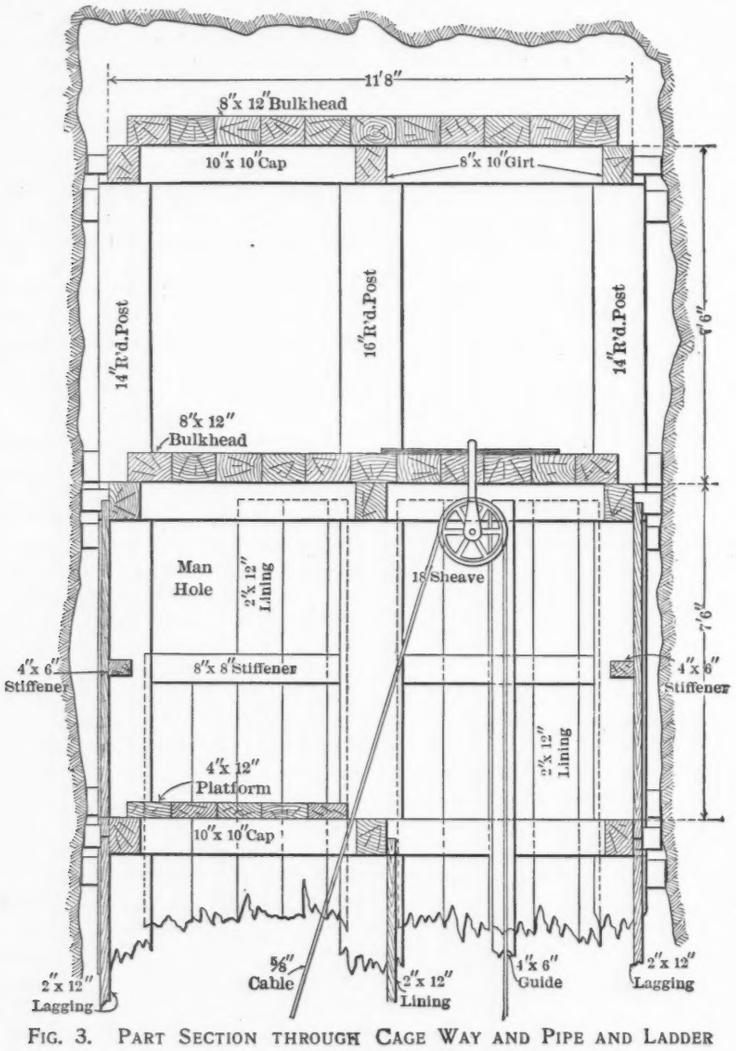


FIG. 3. PART SECTION THROUGH CAGE WAY AND PIPE AND LADDER COMPARTMENTS OF RAISE

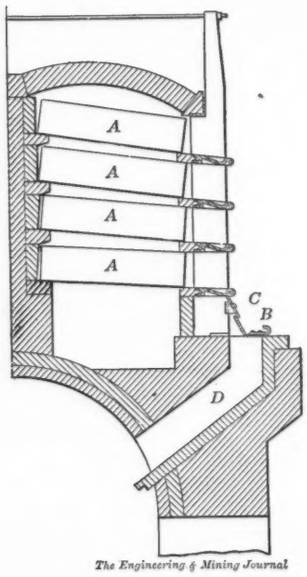
As the development of the mine proceeds, 75 per cent. of the timber used in this raise will be available for other purposes; hence the raise will eventually be credited with 75 per cent. of the cost of that timber; $10 per foot of raise represents the timber cost, so that the true cost of the raise is $71.21, less $7.50, or $63.71 per foot. The work was performed under William Hogan, mine superintendent, formerly of the West Stewart mine, Butte, Mont.

I wish here to express my thanks to Frank P. Mills, general manager of the Giroux Consolidated Mines Company, for courtesies while at the mine and in furnishing the necessary data given in this paper.

The Wettengel Zinc Furnace

An improved form of a smelting furnace, particularly adapted for zinc ores, preventing the waste of the ore when charging and facilitating the discharge is shown in the accompanying illustration.

When the retorts *A* are being charged the pans *B* are placed as indicated in the figure. Any of the material which happens to fall will be caught by the aprons *C* and the pans *B*, and on the completion of the charging, the pans may be withdrawn, carrying the spilled material.



THE WETTENGEL ZINC FURNACE

When the retorts are discharged, the waste is directed into the chute *D* by the aprons *C*, the pans having been removed.

The inventor, C. A. Wettengel, Caney, Kan., has assigned the patent (U. S. Pat. 953,405, March 29, 1910), to the American Zinc, Lead and Smelting Company, Boston, Mass.

The oldest miner in Australia, George Holloway, died May 1 at Wedderburn, Victoria, aged 101 years. Born in England, he went to Australia in 1835, and became a miner very soon after the first discovery of gold in that country. He was an energetic old man, and when 90 years old he set himself the task of cutting a tunnel through a hill, and after three years he concluded his work, the tunnel being a quarter of a mile long; his hopes of finding gold were, however, disappointed.

Proposed Simplification of the Cyanide Process

BY BRUNO MIERISCH *

The process described by A. F. Crosse in the JOURNAL of Feb. 26, has suggested to me two systems of cyanide treatment whereby filtering, filter pressing and zinc-box precipitation may be avoided. Mr. Crosse's apparatus is a sort of modified form of the Pachuca tank, and in his system he claims to avoid filter pressing or decantation. But the modification of the tank seems to offer a means whereby the process may be made a continuous one, in which the handling of the ore is reduced to a minimum.

Two schemes are outlined below, which, so far as I know, have never yet been tried in practice, but they offer theoretical advantages which seem to me of sufficient promise to encourage the trial of one or the other on a practical scale.

In comparing the two systems I consider the first the more simple, but there may be localities where the trouble connected with zinc-box precipitation, and especially with the cleaning of the slimy precipitates, compensates for the higher amount of power required in the second. In either case the ore is slimed in the common way. In cases where the ore is not refractory it will not be necessary to really slime it. An ore broken, say, to 20 mesh will in most cases contain sufficient slime to form a pulp of the requisite consistency with 50 per cent. of solution.

First Method with Customary Precipitation in Zinc Boxes

My first system involves the use of as many "Crosse" tanks as the number of days required for the cyanide treatment of the ore—each tank thus containing one day's production of the mill. An exception may be made where the treatment requires too many days and the tonnage of ore treated is not high, in which case it might be better to reduce the number of tanks and correspondingly increase the dimensions of the remaining ones. Besides these tanks three more are necessary, but of identical design, for reasons to be explained later.

In the accompanying flow sheet *A*, the cyanide treatment is supposed to require three days. The number of tanks is therefore six: Three for the treatment proper; one which is being filled with ore; one being emptied; and the sixth to take up the overflowing solution. We will assume that tanks Nos. 2, 3, 4 and 5 are filled with pulp containing 50 per cent. solution. No. 1 receives its charge of pulp from the mill, having been previously filled with cyanide solution of the necessary strength. No. 6 is empty.

Continuous Process

The air current is then turned on in all tanks except No. 6. The thickened pulp which flows into tank No. 1 drives out a corresponding volume of solution. This passes through zinc box No. 1, is freed from its gold and silver content and pumped from there to the inner portion of the conical vat of Mr. Crosse's reformed Pachuca tank No. 2. The solution here passes through the slimes, and a corresponding quantity of solution will overflow from the outer portion of the tank. It then flows through zinc box No. 2 and is pumped from there to tank No. 3, and so on to tank No. 4, always leaving the content of precious metals in the corresponding zinc boxes. From zinc box No. 4 the solution is pumped into tank No. 6. As this tank was empty, nothing can overflow from it until all the solution in tank No. 1 has been replaced by the inflowing pulp; i.e., after 24 hours. The solution must then be brought up to proper strength by the addition of KCN.

It will be noticed that tank No. 5 was left out of the cycle of cyanide circulation. The ore in this tank, having given up its gold and silver content, is given a wash to replace the KCN solution. The amount of water used in this wash should be equivalent to that lost by evaporation and in the moist ore which is thrown away. The resulting dilute solution is given back to the process at the chilean or tube mill, the ore thus really being broken in a weak cyanide solution.

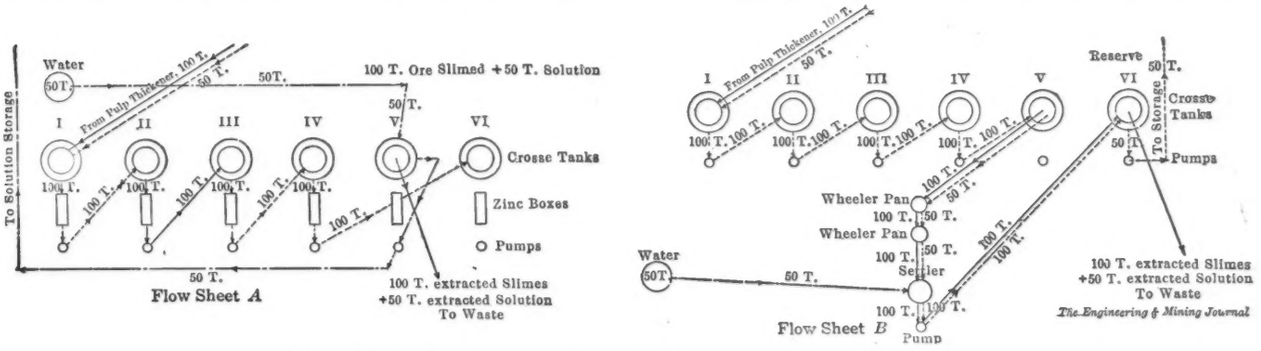
Progressive Cycle of Operations

At the end of the day's run, tank No. 1 will be filled with ore slime, and the solution that it formerly contained will have passed through the pulp in tanks Nos. 2, 3 and 4 and will have filled the empty tank 6. After the wash has been applied the extracted slime is sluiced out from tank No. 5, and this tank is now empty. Next day the same cycle of operations will be repeated, with the exception that No. 6 now takes the place of No. 1 and becomes filled with ore, tank No. 1 becoming No. 2, etc. Tank No. 4 is then washed and sluiced out, leaving the tank empty at the end of the day, and tank No. 5 is filled with solution. On the third day the cycle advances again one tank number, and so goes on continuously.

This process offers the advantages that not only are filtering, filter pressing and decanting in the common sense avoided, but also any handling of the ore. In addition, in many cases, it will make unnecessary the separation of the triturated ore into sands and slime. Furthermore, the amount of water lost can be limited to what the thickened ore pulp contains, a factor well worth appreciation in arid regions.

Amalgamating Pans Substituted for Zinc Boxes

My second system, in addition to the above, does away also with zinc-box precipitation. Only two tanks are required in addition to the number of days of treatment of the ore; in this case five. The treatment goes on as follows: Tanks Nos. 2, 3, 4 and 5, in flow sheet *B*, are



FLOW SHEET ILLUSTRATING PROPOSED CONTINUOUS CYANIDE PROCESS

*Mining engineer, Bluefields, Nicaragua, C. A.

supposed to contain pulp with about 50 per cent. solution. No. 1 is filled with KCN solution of the proper strength and receives its charge of pulp from the mill.

The thickened pulp that flows into tank No. 1 drives out from there a corresponding volume of solution as before. This is pumped into the inner portion of tank No. 2, passes through the slimes of this tank and flows off on the outside into a pump which lifts it up to tank No. 3, from which it goes to tank No. 4, and finally into tank No. 5, where it accumulates.

As solution flows into tank No. 5 the thickened pulp is taken out and directed toward an amalgamation pan. In this pan quicksilver and zinc amalgam, which contains some copper, are added. After a short time (less than two hours) of stirring, all gold and silver from the solution contained in the pulp is precipitated and taken up by the quicksilver, thus forming an amalgam and taking the place of the zinc.

Pan Precipitation an Old Process

As a common Wheeler pan takes about two tons of ore, it can work about 50 tons per day. Therefore, I have shown two pans in the flow sheet. The amalgam is extracted in the usual way by a settler, one for each pair of pans. The quicksilver is separated in the usual way from the nonvolatile metal. The pulp is sluiced out from the settler, or concentrated in case it contains sulphides in paying quantities. With the pulp also goes about 50 per cent. of its weight of solution, with a greater or less KCN content. If the amount of cyanide is insignificant it will not pay to recover it, but it can be recovered in case it is deemed advisable. In case the recovery of the cyanide is desired, the safest way is to pump the pulp from the settler back to another Crosse tank (reserve tank No. 6, flow sheet *B*), let it settle there and send the dilute solution back into the process, as was done in the former example.

Precipitation by Zinc Amalgam

The precipitation of the precious metals from cyanide compounds by means of zinc amalgam is not new, but is known as the Gilmore-Young process. It was successfully used for years in the Santa Francisca mine on a highly argillaceous ore, but finally abandoned. I do not know the cause for this abandonment, but I suppose the extraction sometimes fell short of expectations.

This may be explainable in that the pan was not only used to extract the metal from the solution, but also the whole cyanide treatment of the ore took place in it. As the power costs at this mine are high, the time of treatment was necessarily limited, and it may be that sufficient losses occurred on this account to cause the abandonment of the process in favor of some filtering device.

Mineral Deposits of Western Arkansas

By W. C. B. Allen *

Recent exploration of the Ozark and Ouachita Mountains in western Arkansas and eastern Oklahoma has disclosed a large variety of mineral deposits extending 60 to 75 miles easterly and westerly, on both sides of the Kansas City Southern Railway. The principal portion of these mineral zones is between Mena and Horatio stations in Arkansas. The country rock belongs largely to the undifferentiated novaculite class, and lies in almost perpendicular strata with slight folds giving 5- to 10-deg. dip, both to the north and south, the main strike of the veins being easterly and westerly. The series of rocks exposed by the Ouachita uplift includes quartzite, sandstone, shales and slates, chert, quartz in a crystalized form, with the novaculite and crystaline rocks interspersed with occasional shales. The quartz veins contain lead, zinc, antimony, copper and sometimes gold and silver.

Good Building Slate Reported

Within the area mentioned is an extensive slate field, fully 40 miles long, lying east of Mena on the Hot Springs wagon road. Three varieties of slate, black, purple and gray, suitable for commercial purposes, have been found. The diamond field near Murfreesboro on the Memphis, Paris & Gulf Railway, is located in an igneous region. The peridotite containing the diamonds covers an area of several square miles, but is only exposed at intervals on the surface. About 800 stones have been reported by the four or five companies owning the diamond properties. These are claimed to range in size from one-third to six carats. Little development work has been done thus far and the future of this field is still problematical.

Deposits of manganese have been found, and some shipments made. The veins prospected at the surface show a width of 2 to 20 ft. The deposits lie from 3 to 20 miles east of Mena, Cove and Hatfield stations, Bog manganese in considerable quantity is found in nearly horizontal veins throughout the same area.

Zinc Lead Prospects Opened

The principal zinc, lead and antimony deposits are located both east and west of Gillham station, Sevier county, Ark. Fissure veins 2 to 20 ft. wide outcrop along a mineralized zone for 15 to 20 miles. The surface exposure is generally broken, with scattered fragments of almost white crystaline quartz. In the shaft of the Southern Zinc and Copper Mining Company, at what is known as the Benoni, or Davis mine, four miles west of Gillham, the vein has a width of over 30 ft. between well defined walls. The strike of the veins is north 82 deg. east, with a dip of about 5 deg. to the north.

The ore from this mine is reported to analyze as high as 16 per cent. in zinc, with lead and copper. A shaft probably 130 ft. deep has been sunk on this vein, but no work has been done for some years and the workings are filled with water. Several other lead, zinc and copper deposits have been prospected along this belt, but no record of shipment is available and no work is being done.

Antimony Deposits Require Deeper Development

The principal antimony veins opened are from 3 to 10 miles east of Gillham. There is an outcrop in the northeast quarter of Sec. 7, T. 7, S. R. 31, W. It extends eastward for six to eight miles through the southwest quarter of Sec. 6, T. 7, S. R. 30, W., to the shaft of what was formerly known as the United States Antimony Company, and is traced eastward to the May shaft of the American company at Antimony City, Howard county. This vein is from 4 to 5 ft. thick and has produced several hundred tons of antimony. The shaft is about 120 ft. deep and on the foot-wall a solid streak of stibnite ore 8 to 14 in. wide was mined. The upper and slaty portion of the vein matter carrying some antimony requires concentration before shipment.

Several other shafts and open cuts were made along these veins east of Gillham, and several of the claims have passed into the hands of new people. Unfortunately, owing to the amount of water encountered, the expense of mining operations and the lack of practical experience and capital, this entire district is idle. It will require greater depth, in the judgment of practical mining men, to fully determine the value of these properties. The rate on antimony ores from Gillham to Chicago is about $4 per ton. It is of interest to know that the State and the U. S. Geological Survey will have a party of geologists at work this summer for the purpose of continuing the surveys from the diamondfields of Pike county, westward to the Oklahoma line.

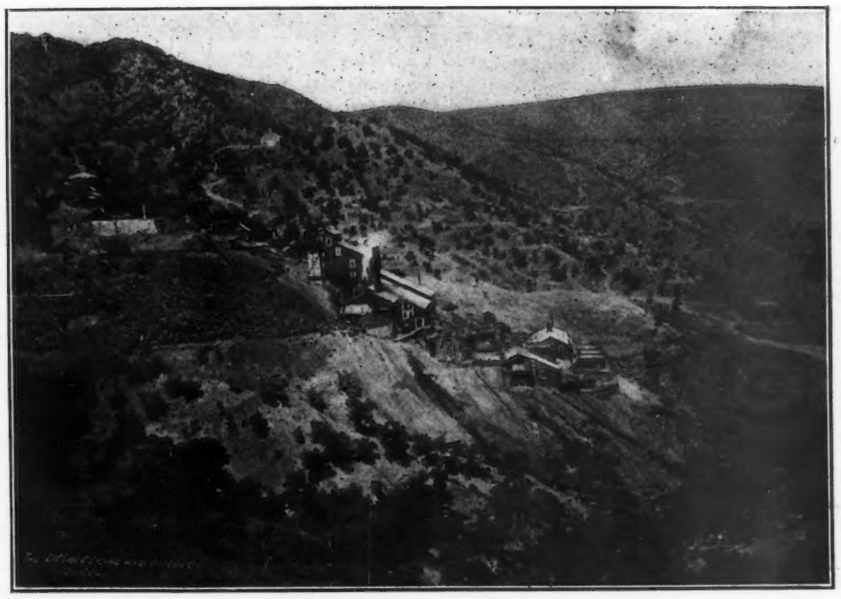
The gold deposits of Egypt are between the Nile and the Red sea. Rude working plans were discovered in Thebes, showing that they were worked as early as 3800 B. C. The Egyptian miners used the "fire and water" method of mining. It might be added that no modernly worked Egyptian mine has paid dividends.

*Geologist, Kansas City Southern Railway Company, Kansas City, Mo.

Some Reminiscences of Old Dolores

BY V. PENDER*

On the occasion of my first visit to the Dolores mines, we left Chihuahua on the morning of Dec. 26, 1898, in an ancient Concord coach drawn by five mules. The weather was bitterly cold, the roads execrable. We traveled day and night, making good time by changing mules about every 15 miles. There were four other passengers, three Mexicans and a bullfighter's "lady"—according to her own account of herself. Mexicans are proverbially light-hearted and inclined to make the best of matters; and their jollity and persiflage helped to mitigate the discomforts of the journey. The bullfighter's "lady," too, made many a merry jest, and we were genuinely sorry to part from her, for her experiences were world-wide and she was but recently from Spain where the *gente de coleta* are held in high esteem by all classes. Surely, mining, like politics, makes strange companions.



THE PRESENT DOLORES MILL, STATE OF CHIHUAHUA, MEXICO

Engineers were in the field, driving stakes for the Chihuahua al Pacifico railroad, on which work was commenced early the next year. The town of Miñaca was not then in existence, and whereas one may now make the trip by rail in a few hours, the coach trip occupied about two days and nights of hard travel.

INCIDENTS OF THE TRAIL

Our destination, the Dolores mines, was about 125 miles due north of Guerrero, in the heart of the wild Sierra Madre. On New Year's day, 1899, we left Guerrero by wagon for Matachic, where the night was passed, and the next day at noon we arrived at Temósachic, then a little mud-built pueblo with one long, narrow street and the inevitable church. After completing arrangements for the hire of two saddle mules, seven pack mules and four *mozos,* we left for the mountains under the guidance of Anastacio Hernandez, a once famous Apache fighter. He knew the country intimately and could be trusted, we were told, to point out the monuments of the various claims comprising the Casavantes property at Dolores.

That night was passed at Naguerachic, the first of the series of large cattle ranches owned by the Hearst estate, and near the site of the town of Madera, established a few years ago by the Greene Gold-Silver company. The next morning we bade farewell to civilization, and plunged into the great pine forest to the north. We ascended the lofty Cuesta de las Chinacas; and then descended to the arroyo, zigzagging, twisting and turning, until my head swam and several times I dismounted and tried to walk. But the trail was too rough, and Anastacio urged me to stick to the mule, always saying in his grim, unbending way: "Remember, *señor,* that the mule has four feet; you have but two." This sensible advice I soon learned to follow and have never met with even a slight accident in traveling more than 1500 miles in the Sierra Madre.

After six days' hard travel we reached the Tutuaca river, and in two hours more the old *hacienda,* guarded by the great rock face called by the Mexicans *El Viejo,* was reached. The long, two-story, adobe building, with its broken shake roof, was unfit to enter, and we lived in our tents during the 31 days passed in the deserted camp. There were a few tumble-down adobe laborers' houses, and a dilapidated old five-stamp mill in the arroyo a thousand feet below the *hacienda;* and where many hundreds of people are now comfortably housed in the Alma de Maria cañon, there was not a dwelling.

ORCHARDS PLANTED BY APACHES

Dolores was entirely deserted, but during the summer and autumn months the few renegades who lived on the Aros river came there to pass the hot months and gather the peaches and apricots from the old trees that lined the arroyo. The seeds were brought, without a doubt, into the Sierra Madre, not by the early Franciscan *padres,* but by the Apache Indians, who planted orchards at all the prominent water holes, making pleasant rendezvous here and there in the wilds for the doughty savages.

EARLY HISTORY OF DOLORES

Like all mines in the remote Sierra Madre, the history of the discovery of Dolores is uncertain. Anastacio told us that some Mexican prospectors from Mulatos discovered placer gold in the early '60's, in the San Francisco (Alma de Maria) arroyo, near its confluence with *Rio* Tutuaca. The news of the discovery spread far and near, and at one time there were more than a thousand persons "panning" from *Rio* Tutuaca to the head of the arroyo, and the source of the metal was traced to the vein now called the San Francisco, which was the first claim denounced in that section. The claim eventually became the property of the Casavantes family, who made other denouncements and worked the Alma de Maria and Rosario claims in a small way at irregular intervals.

The Apache Indians drove out and killed many people, and when Don Juan Solis worked the property for three years under bond and lease, 11 Mexican miners and their families were murdered. Solis built the five-stamp amalgamating mill, which was later rebuilt by Mr. Tracy, who acquired a half interest in the property from Louis Friend, a partner of the Casavantes family. The mill was not adapted to the ore, and the property was closed for several years with the

*International Gold Mines Company, El Socorro, via Ocampo, Chihuahua, Mexico.

exception of brief periods when "chloriders" helped themselves to what they could find. Considerable gold was washed each year after the rainy season at Placeritos, an arroyo farther north and paralleling the Dolores arroyo.

Expert Foretold Value of Mine

The weather was exceedingly cold during our 31 days' stay at Dolores, and on many days ice had to be broken and thawed before the necessary "panning" could be done. "Colors" were few and insignificant. The old workings did not disclose any ore of value, and the dumps had been picked over again and again. Nevertheless, we found evidence that convinced us that the three pertenencias of the Alma de Maria contained a valuable mine.

On returning to Guerrero, a contract was entered into with the Casavantes family to purchase their one-half of the Dolores property on favorable time for 40,000 pesos; and later the interest of Mr. Tracy was acquired for $30,000, making the price of the mines about $50,000, gold.

After a stock company was formed to operate the mines, we returned to Dolores early in June, taking with us a Chinese cook and all of the peons and miners that could be picked up on the way. We traveled by coach to Guerrero, as before. The Chihuahua al Pacifico railroad was under construction, but no passenger trains were yet running to any point on the road.

Early Operating Difficulties

The heavy summer rains began almost immediately after our arrival at Dolores, and it was with the greatest difficulty that supplies were brought in from Temosachic, to which point they were delivered from Chihuahua by slow-moving ox teams. For many days at a time the freighters lay between the Cirupa and the Tutuaca rivers, and often a few of the most essential articles were rafted over the latter stream. No mining was attempted until August, and then labor was so scarce that but little was accomplished until the beginning of the next year. Ten families were brought from Santa Eulalia, at considerable expense, but the miners were lazy, incompetent "Zacs," and all soon drifted away to the Mormon colonies fartner north. Messengers to Mulatos, Pinos Altos, Ocampo and other camps brought in a few miners, and gradually the news of the reopening of old Dolores was noised about; but labor was always scarce during the two years following.

The price of freight from Chihuahua to Dolores was about 75 pesos per ton, our first agent being Don Federico Vega, of Temósachic, who secured freighters at $5.50 per *carga* for more than a year. Corn, beans, potatoes and all other food supplies were at least 25 per cent. cheaper than now. The price of freight per *carga* of 300 lb. from Madera to Dolores, at present, is about $8.50. Peons were paid $1.25 per day, miners from $2 to $3, but most of the mine work was done by contract at a less price. Wood and lumber were delivered 25 per cent. cheaper than now.

Never a Dull Minute at Dolores

Life at Dolores in those days was anything but *triste,* although there was mail but once a week and it required from eight to nine days to send a messenger to Guerrero with a telegram and receive a reply. Some of the random entries from my notebook kept during 1899 read as follows:

"Pitched three tents today in the upper story of the *hacienda,* which is one large room, as a protection from rain and millions of bats. Trying to make *adobes* to fill the yawning gap in the rear wall is slow work, with a rainfall averaging 2 to 4 in. per day."

"Two cats arrived as per order from Temósachic. Will they lessen the billion rats that infest the whole place?" They did.

"Counted the cats today" (Six months later). "There are 23. Not a rat."

"Seven men killed in a drunken brawl on the Aros river, *despues del baile."*

"One man killed, three wounded, one woman injured, last night, 'after the ball.' Ramona (our Mexican servant) eloped. Lung Fat (the Chinese cook) went crazy."

"Two Mexicans found dead near camp. Shot. No clew to murderers. Never is."

"Felipe Bande shot through the stomach as he came from work on the night shift. Bad wound—may live."

"A great deal of trouble with illicit mezcal sellers during the past three months. Nine *demijuanas* were seized last night; but the sellers escaped arrest. They always do."

"After the ball this morning two broken *cabezas* were sewed up, one dislocated arm set; nice *baile,* that, no murder."

The record of crime was a long one, and for the sake of getting any work done, many bad characters were retained during the first year. The mine foremen, José Ochoa and Catarino Cuevas, both sober and peaceable men, were towers of strength in many ways, and one cannot but pay grateful tribute to their unfailing good humor, honesty and loyalty during those two trying years.

Bonanza Discovered by Crosscut Tunnel

As the old works on the vein were insignificant and full of water, badly caved, etc., it was decided to run a tunnel from the north side of the San Francisco arroyo to crosscut the vein system at a depth of about 225 ft. below the surface. This tunnel was begun in August, and made good headway until within 45 to 50 ft. of the great Alma de Maria vein, the existence of which was previously unknown. A crystallized bar here was so hard that two shifts of miners advanced barely 4 in. per day. It seemed more like steel than rock; and all labor was paid by the day, as miners could not have made *tortilla* money under the former rate.

It was discouraging work, but on March 10, 1890, the tunnel encountered what was practically a blind vein in the south end of the pay shoot of the now-famous Alma de Maria mine. Ten feet of ore averaged $125 per ton, about one-third being gold and two-thirds silver. A streak from 4 to 10 in. on the hanging-wall assayed $750 per ton after careful assorting. Forty-two tons of this ore were shipped to El Paso, and the smelters returned $25,050, net. Up to that time, only about $37,500 had been expended on the property, this amount including one payment of $5000 to Mr. Tracy and 2000 pesos to the Casavantes family, to apply on the purchase price.

The first Alma de Maria pay shoot was about 150 ft. in length; then, after drifting north for 200 ft., the second pay shoot was encountered. Ore was regularly shipped for the ensuing two years, and paid for the property and all of the development, and that without machinery of any sort. Only ordinary windlasses were employed to lift the ore and water, the mine being practically dry. In the history of mining development in Mexico there have been few such remarkable records as this.

Neighboring Orebodies Lower in Grade

The Socovon Mayor, farther northeast, was begun simultaneously with the Alma de Maria crosscut, and its objective point was the Rosario mine in the same vein system. The showing in the old works above appeared sufficiently favorable to justify the running of this large tunnel, and quite recently the Dolores company has completed the tunnel and encountered a good grade of ore which often shows a rare form of crystallized gold. Two other tunnels were started early in 1890, on veins on the north side of the Dolores arroyo, but the orebodies were far smaller and the grade of ore lower than in the Alma de Maria mine.

The Dolores mines were sold to the present company about three years after the great bonanza was struck in the Alma de Maria, the purchase price being, I believe, about $1,250,000; and where we found only a wilderness, there is today a well built mining camp of about 4000 people, with hundreds of laborers' houses, offices, stores, hotel, a fine manager's residence, a church, broad roads and a modern 25-stamp mill and cyanide plant netting its fortunate owners $30,000 per month in dividends.

Method of Working a Steep Coal Seam

Details of System Used at Coal Creek Mine in Seam Pitching 38 Deg., where Puncher Machine Has Successfully Met the Unusual Conditions

BY AUSTIN Y. HOY*

The Pacfic Coal Company, of Seattle, Wash., owns and operates through subsidiary companies (The Pacific Coast Steamship Company, Pacific Coast Railway, and Columbia & Puget Sound Railroad) over 26 steamships in the coastwise trade with Alaska, British Columbia and California points, and about 165 miles of railroads. This company built the first railroad in the State of Washington, 38 years ago, and is today one of the largest concerns of the Pacific northwest.

The operation of these steamers and railways requires a large amount of coal. When the Alaska trade is in full swing, over 3000 tons daily are used to supply the demands of this traffic.

The Pacific Coast Coal Company (another subsidiary corporation) owns and operates coal mines at Franklin, Black Diamond, Coal Creek and Burnett, all less than 30 miles south and east of Seattle. The Coal Creek mine adjoins the old Newcastle mine, which was opened some 30 odd years ago, worked to a depth of 2000 ft. to the boundaries of the property, and is now closed down.

Labor Conditions

During the last decade the production of coal has increased so greatly in the United States that the employment of a large percentage of unskilled men as miners has been necessary. Since native-born Americans rarely become coal miners, this labor has been supplied largely by immigration from Italy and the Slav countries, where practically no coal is mined. These circumstances have necessitated the extensive use of machines for doing the work formerly done by skilled miners, namely, "mining" the face of the coal so as to avoid "shooting off the solid" and the consequent production of great quantities of slack and unmarketable sizes of coal.

Character of Seams

Chain machines and compressed-air "punchers" have solved this question under the conditions existing in most of the coalfields of the United States, but in some places the seams pitch so sharply as to render the use of these types out of the question.

This was the situation that confronted the Pacific Coast Coal Company at the Coal Creek mine. Skilled miners were almost unobtainable, and as the coal is a non-coking, semi-bituminous variety, adapted for steam and domestic purposes, shooting off the solid made much unsalable product.

Accordingly, over two years ago, experiments were begun to increase as much as possible the percentage of lump (which brings about $2 a ton more in the Seattle market than the smaller sizes).

Compressed-air post-mining machines of the radial type were installed and it was found that after a mining was put in with these machines, the coal could be sent down the chutes with only a little pick work, and without any powder, except an occasional light shot at a corner or to shoot out a "nigger head." In fact, the powder consumption was reduced over 95 per cent. The lump coal was increased in this way from about 25 per cent. to about 60 per cent., and the practical elimination of powder made the mine much safer.

The first machines used developed sesious mechanical troubles, due to the unusual stresses imposed by frequent falls of coal. About a year ago the company therefore accorded a thorough test to the Sullivan post puncher, and after several months' use an order was placed for 30 machines of this type and make.

The Post Puncher

The accompanying illustration show a "post puncher" in operation in the No. 4 vein of the Coal Creek mine, where the coal is 4½ ft. high and pitches at an angle of 38 deg. As this type of mining machine is practically new in American practice, a brief description may be of interest.

The "post puncher" resembles a rock drill in the fact that it is mounted on a post or column, and uses length bars or steels of various lengths, in doing its work. It resembles the "puncher" or pick machine in its ability to mine across the face, or to shear a room from top to bottom. For this purpose the machine and shell are mounted on a gear segment, controlled by a worm and crank. In mining, the operator swings the bit in an arc back and forth across the face. By loosening one nut the segment may be set in a vertical plane, and a shearing cut made in a similar manner.

This feature is a great convenience when the coal will not shoot readily unless both mined and sheared. A valuable feature of the "post puncher" is the fact that the machine does not swing around the post, but around the center formed

Showing Miners Setting Up a "Post Puncher" in a 38-deg. Seam.

*Spokane, Washington.

by the socket, in which it is clamped, about 6 in. from the post. It is, therefore unnecessary to set the column exactly square with the intended mining, but the machine may be set in a few seconds to mine wherever desired, regardless of careless placing of the post. This is a patented feature, possessed by no other similar machine. Dismounting the machine when swinging from the mining to the shearing position is also unnecessary.

to resist the heavy shocks and strains received from falling coal. Felt packing of a very durable character and having an adjustable gland, is employed. A combined shell adjustment and stop, to prevent feeding too far, and a rotation without springs, provided with five round steel pins or pawls, are other interesting features of the "post puncher" design.

The exhaust cap is so arranged as to throw the air in any desired direction to avoid raising dust. The extension rods

clay near the roof, and is accordingly above the segment. In the 6-ft. "Muldoon" vein, the impurities are lower in the seam and the machine is hung below the segment.

Method of Operation

The rooms are driven 45 to 50 ft. wide. The first cut is made from a post set 7 ft. from the left rib and about 18 in. from the face. See the sketch on this page. A mining eight feet in depth is

"Post Puncher" in Coal Creek Mine with 80-inch Extension in Use

Sullivan "Post Puncher" Starting a Cut in the Coal Creek Mine

Bottom of Slope at Coal Creek Mine

Loading Coal in Muldoon Seam. Note Man at Chute in Rear

The cylinder and valve motion embody other novelties. The front head is solid with the cylinder, thus eliminating the complication of side rods. When the coal is missed, the piston will overrun the front port and stop, thus obviating damage to the front head. This overrunning occurs very seldom with a skilled operator, but the delay attendant on feeding the machine against the coal, so that it will start again, is nothing to the delay due to breakage that would occur eventually if the piston could strike the front head. The cylinder is made of steel,

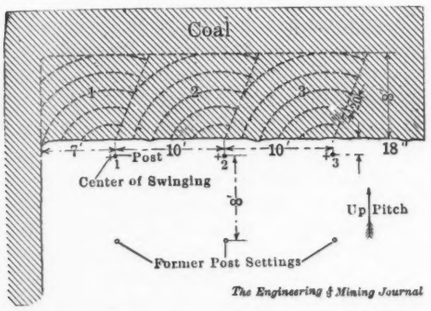
or length bars range from 20 to 100 in. in length, and are tapered at both ends, one to fit the chuck and the other to receive the bit holder. This bit holder has tapered holes for from three to seven chisels or bit points. A solid bit may be used instead, depending on the nature of the cutting.

The mining may be put in at any desired hight in the seam, so as to mine in fireclay, the coal itself, or in a dirt band, by raising or lowering the clamp on the post. In the illustrations, the machine is shown mining in a band of bone and

put in, using an extension bar 80 in. long. The chuck enters the cut, which accounts for the mining being deeper than the length of the extension. After the 80-in. extension has been swung, a 100-in. bar is used to square up the cut. One man operates the machine, swinging it by means of the worm crank with one hand, and feeding the cylinder forward two or three turns with the other, at each end of the swing.

Although the cuttings fall out of the cut without scraping, due to the pitch, a helper is required to set up, pick down

coal, etc. When the operator is completing the left rib cut, the helper sets up a second post about 10 ft. from the first one, or about 17 ft. from the left rib and 18 in. from the face. Upon finishing the rib cut, the machine and swinging attachment are transferred to the second post with only a few minutes' delay. While the operator is making the second cut, the helper takes the first post down and resets it about 27 ft. from the left rib for the third cut, and so on, until



SKETCH ILLUSTRATING SYSTEM OF MINING WITH PUNCHER

the face is crossed. Only a half swing is used, so that the operator is protected by the unmined coal, as well as by the machine itself, from the coal loosened from the face by the mining.

The machine and posts remain in the room at the face until the room is completed, for there is no shooting of the coal that can injure the machine nor any loading (as in a flat seam) that the machine would interfere with. Hence there is no waste of time due to moving, except from post to post, and little heavy lifting. Two men can set up with ease, as the heaviest parts (the machine and shell) weigh only 225 pounds.

ECONOMIC RESULTS

These machines average about 300 sq.ft. in an eight-hour shift, or from 45 to 55 tons per machine per shift, according to the hight of the coal. While, as stated above, the reason for the installation of these machines was solely to increase the proportion of lump coal, even if the cost of mining was increased, the results point strongly toward a material reduction in the cost of mining, after all interest, depreciation, power, pipeline and maintenance charges have been made against the machines.

In shooting off the solid, the former method, a yardage system of payment was used, the rate being $9.50 for a 50-ft. room. Three men worked together furnishing their own powder. The reason for using a yardage and not a tonnage system was because of the impurities in the seams, and the pitch. The coal and debris go down the chutes together to the slope, thence in mine cars hauled by electric locomotives to the surface and through a preparing plant of picking tables and washers.

GENERAL MINING FEATURES

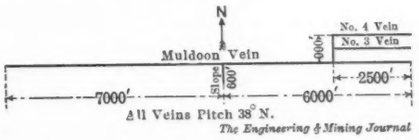
The mine in which these machines are used is a new one and is worked from a slope 600 ft. deep, sunk on the pitch of the seam. It adjoins an old mine of the same company, operated through a tunnel. The old mine is nearing exhaustion, but is still furnishing about 600 tons daily.

The new mine is to be worked upon the retreating room-and-pillar system. The entries have nearly reached the boundaries of the property at this writing, and when this is accomplished they will appear as shown by the accompanying sketch.

A Sullivan straight line two-stage steam-driven air compressor with a capacity of 1843 cu.ft. of free air per minute has just been installed at these mines and a new pipe line laid. The management now plans to put the new mine on one-half capacity (600 tons daily), operating about 12 Sullivan post punchers. Later on, when the old mine is exhausted, the compressor and machine plant will be doubled and the production increased to 1200 tons.

APPLICATIONS OF THE POST PUNCHER

While the use of Sullivan post punchers is particularly adapted to heavily pitching seams, they are also useful in flat seams, where it is desirable to mine



PLAN OF THE COAL CREEK MINE

in a dirt band above the floor or near the roof. In seams where the cuttings do not fall from the mining by gravity, the helper keeps the cut free by means of a long-handled flat shovel or a scraper.

In some fields these machines have been successfully used for driving entries and for shearing they can hardly be excelled, especially when both mining and shearing cuts are required, owing to the quickness and ease with which the setting may be altered for either purpose.

From the foregoing description, it has been noted that the post puncher was used at Coal Creek with only a half swing, and that the posts were therefore set only 10 ft. apart. In stronger coal, or in a flatter seam, where the danger to the operator and machine from falling coal is less serious, the machine is used to cut on both sides of the post, from the same setting, having a maximum capacity of about 18 ft. of face from one set up. To keep the ribs or side walls of an entry or room straight, the bit is swung back and forth across the corner, gradually advancing it with the feed screw until the angle is square. Or a hole may be drilled at the extreme end of the swing to the full length of the feed screw, then the bit cranked back and the mining made up to this hole at each swing.

I desire to render my thanks to J. J. Jones, superintendent of the Coal Creek mine, Newcastle, Wash., for much data used in this article.

The Difference Between Permissible Explosives and Black Powders

Explosive circular No. 3, issued by the United States Geological Survey, contains the following announcement:

With a view to the wide use of these permitted explosives, it may be well in this connection to point out again certain differences between permissible explosives as a class and the black powders now so generally used in coal mining, as follows:

(a) With equal quantities of each, the flame of the black powder is more than three times as long and has a duration 3000 to more than 4000 times that of one of the permissible explosives. The rate of explosion also is slower.

(b) The permissible explosives are 1¼ to 1¾ times as strong, and are said, if properly used, to do twice the work of black powder in breaking down coal; hence only half the quantity need be used.

(c) With 1 lb. of a permissible explosive or 2 lb. of black powder, the quantity of noxious gases given off from a shot averages aproximately the same, the quantity from the black powder being less than from some of the permissible explosives and slightly greater than from others. The time elapsing after firing before the miner returns to the working face, or fires another shot, should not be less for permissible explosives than for black powder.

The use of permissible explosives should be considered as supplemental to and not as a substitute for other safety precautions in mines where gas or inflammable coal dust is present, other conditions indicating danger.

As stated above they should be used with strong detonators, and the charge of the explosives used in coal mining should not exceed 1½ lb., and in many cases need not exceed 1 pound.

A high rate of wages artificially maintained in a falling market causes irregular work and reduced earnings. It is more advisable under such circumstances to reduce wages to such a rate as can be paid without lessening employment.

The Avoidance of Coal Mine Strikes

By Floyd W. Parsons

There has recently been much agitation looking to greater safety in coal mining and the elimination of wasteful methods of operation. We hear but little, and few suggestions are made, concerning the great economic losses due to mine suspensions. Of all our important industries, none is so afflicted with this evil as coal mining. If coal operators and miners cannot find a sensible and civilized way to settle their difficulties, it is almost inconceivable that the public themselves have permitted the constant repetition of this disturbing practice. In fact, it seems that most everyone has come to believe that the biennial strike is a legitimate part of the coal business.

The time is not far off when sensible operators, miners, and the public at large, will see the folly of the present course, and refuse to submit further to the inconveniences and losses that result. One hopeful sign is "the limelight" that is being given to the differences that exist between labor and capital. Just a little more of such publicity, and a poor cause will always be compelled to yield to that most potent of all forces, public opinion.

It would be well if the operators and the miners ceased making contracts to expire at a given date, and, instead, would make their agreements subject to termination on 30 days' notice on the part of either subscriber, with a clause providing that operation will be continued for 60 or 90 days after cancelation, and pending the negotiation of a new wage scale. Such action should be further strengthened by the passage of an arbitration act covering disputes incident to interstate transportation.

The Strike Question Largely Solved

The Canadian Government has practically solved the strike question in that country. A law, called the "Industrial Disputes Investigation Act" makes it illegal to resort to a strike, in any industry known as a public utility, until the matters in dispute have been investigated by a Board of Conciliation established under rules by the Canadian Minister of Labor. Under this act, either party to a dispute may apply for an appointment of a board of investigation. Each of the two parties to the dispute may nominate one member of the board, and these two may select the third, who serves as chairman of the board of three. If either party fails to nominate a member, the Minister of Labor appoints that member, and if the two members fail to agree upon the third member, the Minister appoints the third member. It is evident, therefore, that in this way the board will always be constituted, and will go to work, if either party to the dispute applies for an investigation. The proceedings of every board appointed and its final report are published throughout the Dominion in the most complete manner.

During the two years from March 22, 1907, to the end of March, 1909, 55 applications, in Canada, were received for the appointment of boards. Of the 55 applications received, strikes were avoided or ended in 25 coal mines, four metalliferous mines, 15 railroads, and three street railways. Strikes were also avoided in two bodies of longshoremen, one body of teamsters, in one body of sailors, and in two industries not public utilities. There were but two cases out of 55, therefore, in which strikes were not averted.

As to the question of whether the "Industrial Disputes Investigation Act" has been effective in Canada, it may be stated in answer that since its enactment, the Dominion has experienced no cessation in the continuous operation of its great agencies of communication, or other public utilities.

Many will hesitate to acknowledge the fact, but it does appear that we in the United States are not only submitting to conditions that are becoming unbearable, but that are unnecessary. We waste our time talking of plans for the disarmament of nations when we cannot even settle our own business disputes without bloodshed and riot. It is not that we lack in legislation, for we have laws in plenty; what we need in the way of Government is quality, not quantity.

The Illinois coal operators at the present moment, because of a strike, are sacrificing more than $2,000,000 a month, in addition to losing their market to operators in adjacent States. When other operators with a better quality of coal succeed in introducing their superior product to the customers of mines that are undergoing a suspension, it is no easy matter for the losing operators to regain their trade. Worse than all else, neither the operator nor miner eventually succeeds in obtaining anything that could not have been brought about in a more sensible way. Property is destroyed and deteriorates through non-use, and the miner and his family starve. The principle back of strikes is all right, but the method of upholding is wrong.

Regular Employment Should Be Most Sought

High wages are to be desired, but ancient as well as modern economists assure us that a high rate of wages forced by main strength and artificially maintained, is sure to cause irregular work, and consequently, no increase in the annual earnings of labor. It is better to have wages on a level where employment will be regular and constant.

Coal mine operators in the United States are not afraid of proper laws, as nearly uniform in the various States as conditions will permit, and drafted by men who know the industry; but they do fear hasty, ill-advised legislation that benefits one district and embarasses others.

Strikes are the curse of the industry, and benefit only the walking delegate of the union, and the jobber or coal broker who exploits prices. Such suspensions can and should be abolished. If we cannot improve on the legislation adopted by Canada, we can at least profit by her experience. We have our Erdman act, covering disputes relative to interstate transportation, but in order to be effective in the avoidance of all strikes, this law would have to be amplified and revised, making it applicable to all industries. However, it might be safer to quit experimenting and pattern an act after the Canadian law which has proved successful. We already have a sufficiency of laws that cannot be interpreted even by our highest court, so that something simple, plain and effective would be relished.

The Manufacture of Peat in Canada

The Mines Branch of the Department of the Interior of the Dominion Government has established a plant for the manufacture of peat into fuel, at Alfred, Ont., about 45 miles from Ottawa. The plant is in sucecssful operation and was built by the Government to demonstrate the possibilities of the peat bogs, with which Canada abounds. The plant commenced operations May 18, and is now running continuously. The peat deposits at Alfred consist of about 300 acres, having an average depth of about 10 feet.

The plant consists of a long peat-storage shed, two small frame houses, a blacksmith shop and a large peat machine. The latter apparatus was imported from Sweden, where there are several hundred such equipments in operation.

Method of Operation

The general scheme of development is to cut a long trench, 19 ft. wide, 8 ft. down in the peat, and then place the peat machine in this cut. A carrier conveys the peat as it is dug from the trench to a hopper. On a 600-ft. circular track in the middle of the bogs are 8 peat carriers, each of which holds 0.7 ton of peat. As each car passes the machine, the ground peat is dropped from the hopper into the machine. A 34-h.p. engine, which itself burns about 4 tons of peat fuel per day, furnishes motive power for both hopper and cable cars.

The next operation is to convey the peat in the carriers to what is known as a field press. This spreads the peat

upon the ground in long parallel rows and it is then shaped into bricks by means of a three-knived instrument, which is operated by boys. After this, the bricks are allowed to dry in the sun and air for three or four weeks, when they are stored in the peat shed ready for transportation.

At the present time, the capacity of the plant is about 25 tons per day. Fourteen men and two boys are employed, the men receiving $1.75 per day and dinner, while the boys receive 8c. for every 1000 bricks turned over.

The superintendent of the plant has stated that he can produce peat for from $1.75 to $1.80 per ton. One and four-fifths tons of peat equal one ton of anthracite. The peat fuel will burn in any stove, but for houses, a special stove is necessary on account of the fineness of the ash. Peat takes about twice as much room for its weight as coal, and it is an excellent fuel to use in connection with producer gas. In the case of the Alfred peat bogs, the Government authorities say that this land is practically useless for agricultural purposes, so that its employment as a source of fuel means the reclamation of land otherwise waste.

Ontario is one of the provinces in Canada that lacks a supply of coal, and as a consequence, the importance of the peat deposits cannot be overestimated. A peat-using plant for the production of producer gas has been established in Ottawa and receives its fuel from the peat-manufacturing plant at Alfred.

Work is Resumed at Mulga Mine

The Alabama State Mine Inspector James Hillhouse and Associate Inspectors Dickinson and Neill were at Mulga, Tuesday, May 31, and made a thorough examination of the mine and machinery preliminary to the resumption of work at the mine. The company will start work with a fair-sized force of men.

Mr. Hillhouse said that he and his associates found everything at Mulga in good working order and that he readily gave his permission for the starting of the mine. Mr. Hillhouse further stated that the mine is now equipped with electric firing apparatus that will enable all the blasting to be discharged from the outside while there is not a man in the mine. The water system is good, there being pipes into all the headings and openings at every second room, where hose can be attached and every part of the mine sprayed to lay the deadly dust that is sometimes the cause of an explosion. Mr. Hillhouse also said that he considered the mine in safe working order and that if every mine in the district were so equipped, a mine explosion would be almost an impossibility.

COLLIERY·NOTES

For coal and lignite high in moisture, or high in ash, the gas producer, used in connection with a gas engine, is best adapted to develop power, but for the generation of steam, which can be used for heating as well as for power, coal may be more conveniently burned in a specially constructed furnace under a boiler.

It is just as necessary that the different types of safety lamps should be tested by the Government and placed on a permitted list, as it is that explosives should be so tested. Such a test would not only tend to improve the type of safety lamps by stimulating invention, but also prevent the use of imperfect types, such as have led to accidents in the past.

Safety lamps that are fastened with a "screw lock" cannot be too severely condemned. Lamps locked by means of lead rivets, and especially those that are fitted with magnetic locks, are much safer. Another point in the construction of safety lamps is the danger arising from the gauze being accidentally omitted. In several instances, explosions have occurred from this cause. A number of safety lamps now on the market are so constructed that the lamp cannot be put together without the gauze. This plan is excellent, and should be a feature in all safety lamps.

In purchasing coal for any power plant, the aim should be to obtain a fuel which, all things considered, will produce a horsepower for the least cost. Experiments seem to indicate that almost any fuel may be burned with reasonable efficiency in a properly designed apparatus. The recognized requirements are as follows: (1) A uniform and continuous supply of fuel to the furnace; (2) an air supply slightly in excess of the theoretical amount required for complete combustion; (3) a temperature sufficiently high to ignite the gases that are driven off from the fuel; (4) a complete mixture of these gases with the air supplied before they reach a cooling surface, such as the shell or tubes of a boiler.

It is evident from facts before us that the Miners' Union as well as other labor organizations in this country, are, in great measure, attempting to ignore all economic laws. Unionism is operating more and more to prevent free competition of labor. This tendency to maintain a higher and more uniform rate of wages is commendable if only the union would also maintain the efficiency of labor. The greatest fault of trade unionism is its tendency to limit the efficiency of its members and to place the bad workmen on a level with the good. The result of such action is to level down rather than up, and causes the miner to falsely believe that he is helping his cause by restricting his labor.

At the mine of the Moores Run Coal Company, Fairmont, W. Va., the entire haulage work is done by an 8-ton locomotive of the Goodman single-motor type. Careful records of the coal hauled are kept, and these figures for one recent month showed as follows:

Tons of coal hauled	30,400
Tons of rock hauled	2,500
Total tons hauled	32,900
Number of working days	22
Average number of tons per day (8 hours)	1,496
Average number of tons per hour	187
Average number of trips per day (8 hours)	29.5
Average number of tons per trip	50.7
Cars hauled per hour	83
Average length of haul, feet	2,400

The haulage roads are nearly level, the worst grade being about 2 per cent. against the load for a short distance.

One engineer has correctly stated that some of the greatest losses in coal mining at present result from the failure of the miner to carry on the operation of rib-drawing systematically and steadily. This same authority says: "There are mines in this country where the miners in 75 per cent. of the working area are engaged in drawing pillars. Just as long as each miner advances at a certain rate of speed and regularity, and pays attention to proper mining, so long will the greatest percentage of coal be extracted; but the moment one miner lags, trouble begins, and when mining operations are suspended by reason of a strike or other cause, a great loss must and will occur. If some mines were stopped suddenly at certain periods in the operation of rib-drawing, it would result in the utter ruin of the property."

Notwithstanding the great agitation favoring conservation of our natural resources, the losses in coal mining continue unrestrained. Probably the greatest loss of coal occurs at hundreds of mines in this country, where mining operations are carried on in seams averaging from 8 to 15 ft. in thickness. In probably 75 per cent. of such cases, the mining company extracts only 6 or 7 ft. of the seam, leaving the remainder of the bed to form a top. Many excuses are advanced to justify this plan of mining. The most common excuse is that the rock or slate overlying the seam is too weak to form a good roof and the coal has to be left in as a supporter. In many cases, the real truth of the matter is that the operators are anxious to get rich quick, and, knowing that it is easier to mine 6 or 7 ft. of coal rather than a greater thickness, they adopt this wasteful policy, leaving future generations to pay the price. In many of the older districts of this country, where wasteful methods of mining were employed, more than a decade ago, and the mine afterward abandoned, new companies are reworking these old pits and making a profit, although the sensible and economical plan would have been to have extracted all the seam in the first mining.

MINING AND METALLURGICAL PATENTS

A CLASSIFIED LIST OF NEW INVENTIONS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COAL AND COKE

COKE—Folding Coke- and Coal-Handling Machine for Coke Ovens. James E. A. Moore, Cleveland, Ohio, assignor to John W. Seaver, Cleveland, Ohio. (U. S. No. 959,246; May 24, 1910.)

COKE—Improvements in or Relating to Apparatus for Closing the Doors of Retorts, Coke Ovens or the Like. Ofenbau Gesellschaft, m. b. H., Munich, Germany. (Brit. Nos. 27,919 and 28,027 of 1909.)

COKE—Improvements in or Relating to Burners of Coke Ovens or the Like. F. W. C. Schniewind, New York. (Brit. No. 10,482 of 1909.)

COKE—Improvements in or Relating to Charging Coke Ovens. F. W. C. Schniewind, New York. (Brit. No. 10,485 of 1909.)

COKE—Process for Coking Coal. Samuel B. Sheldon, Buffalo, N. Y. (U. S. No. 959,080; May 24, 1910.)

COKE—Process for Quenching Coke. Eduard Schulte, New York, N. Y., assignor to United Coke and Gas Co. (U. S. No. 958,184; May 17, 1910.)

COKE—Process of Quenching Coke. Heinrich Koppers, Essen-on-the-Ruhr, Germany. (U. S. No. 958,651; May 17, 1910.)

GAS DETECTION—Indicating and Measuring Device for Use in Mines or Wherever Desired to Detect Presence of Combustible Gases. Harold H. Clark, Pittsburg, Penn. (U. S. No. 960,823; June 7, 1910.)

MINING MACHINES — Improvements in or Connected with Cutting Machines for Use in Mining or Quarrying Minerals, Particularly Adapted for Use in Mining Coal and the Like. Mavor & Coulson, Ltd., and Samuel M. Mavor, Glasgow, Scotland. (Brit. No. 11,206 of 1909.)

PEAT—Drying Apparatus for Peat and the Like. Charles A. Matheson, Perth, Ontario, Canada, assignor to George Baxter Farmer, Perth, Canada. (U. S. No. 957,232; May 10, 1910.)

SLATE PICKER. Harry A. Whitman, Jermyn, Penn. (U. S. No. 958,343; May 17, 1910.)

WASHING—Improvements in Washing or Mixing Apparatus for Treating Clays, Ores, Coal and the Like. William A. Mercer, London. (Brit. No. 9672 of 1909.)

COPPER

SULPHIDE ORE TREATMENT—Process of Treating Sulphide Ores Containing Copper. Joseph McFetridge, Vandergrift, Penn. (U. S. No. 959,578; May 31, 1910.)

GOLD AND SILVER

AMALGAMATING APPARATUS. Walter Montgomery and Gustave Weithas, Brooklyn, N. Y., assignors of one-third to Edward Staats Luther, New York, N. Y. (U. S. No. 955,604; April 19, 1910.)

AMALGAMATION—Trap for Precious Metals. Pierre Armand Brangier, Agnew, Cal., and Royer Luckenbach, Philadelphia, Penn. (U. S. No. 959,300; May 24, 1910.)

CYANIDATION—Apparatus for Quick Cyaniding of Precious Metals. Pierre Armand Brangier, Agnew, Cal., and Royer Luckenbach, Philadelphia, Penn. (U. S. No. 959,301; May 24, 1910.)

CYANIDATION—Precipitation of Metals from Cyanide Solutions. Stafford F. Kirkpatrick, Kingston, Ontario, Canada. (U. S. No. 959,757; May 31, 1910.)

EXTRACTION—Improvements in the Extraction of Gold. Frederick A. Ford, London, England. (Brit. No. 7101 of 1909.)

FILTERING APPARATUS. Ernest P. Dargin, Denver, Colo., assignor to Mary E. Dargin, Denver, Colo. (U. S. No. 959,844; May 31, 1910.)

SOLVENT—Improved Solvent for Precious Metals. John Penhale, and Harry Ormes Mascall, Johannesburg, So. Africa. (Brit. No. 8682 of 1909.)

TUBE MILLS—Feeder for Tube Mills. Everest A. Baylis, Madera, Mexico. (U. S. No. 960,782; June 7, 1910.)

IRON AND STEEL

BLAST-FURNACE GAS—Furnace for Burning Blast-Furnace Gases. Henry E. Parson, New York, N. Y., assignor to Parson Manufacturing Company, New York, N. Y. (U. S. No. 958,429; May 17, 1910.)

DRY-AIR BLAST—Process of Drying Air. Hermann A. Brassert, Chicago, Ill., assignor to James Gayley, New York, N. Y. (U. S. No. 958,471; May 17, 1910.)

LEAD, ZINC AND OTHER METALS

LEAD AND ZINC—Smelting Process. Eduard Dedolph, Kaslo, British Columbia. (U. S. No. 959,924; May 31, 1910.)

NICKEL—Process of Reducing Nickel Hydrosilicate Ores. Adolphe Chalas, Philadelphia, Penn. (U. S. No. 959,460; May 31, 1910.)

ZINC—Improvements Relating to the Extraction of Zinc. Charles S. Brand, Bentinck Drive, Ayr, England. (Brit. No. 9955 of 1909.)

MINING—GENERAL

BLASTING—A Composition or Compound for Neutralizing the Noxious Fumes Produced by Blasting. William Burgess, Camborne, Cornwall. (Brit. No. 12,988 of 1909.)

DRILLING—Means for Collecting Drill Cuttings. Martin L. Sargent, Leadville, Colo., assignor to the Drill Dust Catcher Co. (U. S. No. 956,181; April 26, 1910.)

EXCAVATING SHOVEL. Charles J. Reise, Omaha, Neb. (U. S. No. 955,285; April 19, 1910.)

EXCAVATOR—Power Excavator. John B. Webber, Jr., Toledo, Ohio, assignor to the Vulcan Steam Shovel Co., Toledo, Ohio. (U. S. No. 13,107; April 26, 1910.)

HOISTING—Catching Devices for Cages. Heinrich W. Solfrain, Holsterhausen, Wanne, Germany, assignor to Max Schimmel, Wanne, Germany. (U. S. No. 956,214; April 26, 1910.)

HOISTING DEVICE. Edward O. Carvin, Manhattan, Nev., assignor of one-fourth to James Mcosh Smith, Manhattan, Nev. (U. S. No. 957,865; May 17, 1910.)

MINE-CAR BUFFER. Victor E. Lane, Berwick, Penn., assignor to American Car and Foundry Company, St. Louis, Mo. (U. S. No. 959,232; May 24, 1910.)

MINE CARS—Latch for End Gates of Mining Cars. Isaac K. Beaver, Wilburton, Penn., assignor of one-half to Elmer E. Straub, Wilburton, Penn. (U. S. No. 958,075; May 17, 1910.)

MINER'S LAMP. Louis Klun, Spaulding, Ill. (U. S. No. 953,093; March 29, 1910.)

TUNNELING MACHINE. George R. Bennett, Denver, Colo. (U. S. No. 958,952; May 24, 1910.)

ORE DRESSING—GENERAL

CONCENTRATION — Grate for Concentrator Jigs. Sterling P. Robinson, Galena, Kan. (U. S. No. 960,111; May 31, 1910.)

CONCENTRATION—Improvements in or Relating to the Concentration of Ores. H. L. Sulman and H. F. K. Picard, London, England. (Brit. No. 28,173 of 1908.)

CRUSHER. Arthur Niedermeyer and Richard Bernhard, Milwaukee, Wis., assignors to Power and Mining Machinery Co. (U. S. Nos. 960,231 and 960,232; May 31, 1910.)

CRUSHER—Gyratory Crusher. George F. De Wein, Milwaukee, Wis., assignor to Allis-Chalmers Co., Milwaukee, Wis. (U. S. No. 961,084; June 7, 1910.)

DECANTING—Tilting Appliance for Decanting Oils and Liquids. Percival T. White and George Robertson, Perth, Western Australia. (U. S. No. 957,829; May 10, 1910.)

DEWATERING—Improvements in Means for Separating Pulverized Ore or Other Comminuted Solid Matter from Liquid. Alex. J. Arbuckle, and Alfred Osborne, Belgravia, near Johannesburg. (Brit. No. 24,402 of 1909.)

DEWATERING—Improvements in Tanks or Vessels for Separating Comminuted Solid Matter, such as Pulverized Ore from Liquids. Alex. J. Arbuckle, Belgravia, near Johannesburg, Transvaal. (Brit. No. 24,403 of 1909.)

DEWATERING — Means for Separating Comminuted Ores or Other Solid Matter from Liquid. Alex. J. Arbuckle, Johannesburg, burg, Transvaal. (U. S. No. 958,086; May 17, 1910.)

DEWATERING — Process of Separating Liquids from Solids. Horace G. Nichols, Ymir, British Columbia, Canada. (U. S. No. 959,272; May 17, 1910.)

DEWATERING—Process of Separating Solids from Liquids. Wilbur Alson Hendryx, Denver, Colo. (U. S. No. 960,547; June 7, 1910.)

DEWATERING DEVICE. Wilbur Alson Hendryx, Denver, Colo. (U. S. No. 960,546; June 7, 1910.)

ELECTROSTATIC SEPARATING PROCESS. Walter G. Swart, Denver, Colo., assignor to the Blake Mining and Milling Co. (U. S. No. 959,646; May 31, 1910.)

FILTER. George Moore, Salt Lake City, Utah. (U. S. No. 955,660; April 19, 1910.)

MAGNETIC SEPARATOR. Walter B. Transvaal. (U. S. No. 958,086; May 17, 1910.)

ORE CONCENTRATOR and Classifier. Martin Prior Boss, San Francisco, Cal. (U. S. No. 959,838; May 31, 1910.)

SCREENING—Improvements in or Relating to Machinery or Apparatus for Screening Crushed Stone, Ore and Like Materials. William H. Baxter, Leeds, England. (Brit. No. 16,179 of 1909.)

SCREENING MECHANISM. William Walter Willson, Columbus, Ohio, assignor to the Jeffrey Manufacturing Co. (U. S. No. 959,671; May 31, 1910.)

SEPARATION—Apparatus for Electrical Separation. Henry Azor Wentworth, Newton, Mass., assignor to Huff Electrostatic Separator Company, Boston, Mass. (U. S. No. 960,470; June 7, 1910.

METALLURGY—GENERAL

BRIQUETTING—Process of Briquetting Fines of Ore, Furnace Dust, Waste Metal, Waste Iron, Etc. Max Glass, Vienna, Austria-Hungary. (U. S. Nos. 958,623, 958,700 and 958,701; May 17, 1910.)

ELECTRIC FURNACE. John W. Evans, Belleville, Ontario, Canada. (U. S. No. 960,862; June 7, 1910.)

ELECTRIC INDUCTION FURNACE. Karl A. F. Hiorth, Christiania, Norway. (U. S. No. 954,804; April 12, 1910.)

FURNACE—Revolving Furnace for Volatilizing Metals from their Ores. Harry H. Hughes, Springfield, Mo. (U. S. No. 13,118; reissue; May 31, 1910.)

ORE TREATMENT—Process of Treating Ores and Carboniferous Earths. Alfred Arthur Lockwood, London, England, assignor to the L. & S. Syndicate, Limited, London, England. (U. S. No. 959,239; May 24, 1910.)

REFRACTORY ORE TREATMENT—Process of Reducing Refractory Ores, Particularly Oxides and Sulphides. Gideon Boericke, Philadelphia, Penn. (U. S. No. 958,851; May 24, 1910.)

REGENERATIVE FURNACE. Franz Meyer, Englewood, N. J., assignor to Metallurgical Company of America, New York, N. Y. (U. S. No. 958,150; May 17, 1910.)

ROASTING FURNACE—Self-Heating Hot-Blast Roasting Furnace. William M. Barker, McGill, Nev., assignor to Allis-Chalmers Co., Milwaukee, Wis. (U. S. No. 961,081; June 7, 1910.)

SLAG—Method of Handling Slag. David T. Croxton, Cleveland, Ohio. (U. S. No. 959,720; May 31, 1910.)

SMELTING—Art of Smelting Ores. Arthur S. Dwight, San Luis Potosi, Mexico. (U. S. No. 959,484; May 31, 1910.)

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

T. Lane Carter, of Osgood, Carter & Co., Chicago, is examining mines in Nevada.

G. A. Rist, Jr., is on his way home to Bloomfield, N. J., after three years mining work in Peru.

John Hays Hammond will go to his summer home at Gloucester, Mass., about the end of June.

A. B. Dalley, of Pittsburg, has been appointed general manager of the Arkansas Natural Gas Company.

P. L. Marston has assumed his duties as superintendent of the Yaqui River Smelting and Refining Company, Sonora, Mexico.

Henry F. Lefevre has returned to New York after an absence of 10 months in Costa Rica, Guatemala, Salvador and Nicaragua.

J. C. Biedelman, of Montreal, has gone to the Sturgeon Lake district, Ontario, in the interests of a syndicate which owns several mining locations.

E. A. Cole has been chosen president of the Sunday Creek Company, of Ohio, in place of W. K. Field, who has gone to the Pittsburg Coal Company.

Thomas Heney, lately in charge of the Tamarack and Custer mines in Idaho, has been elected a director of the Tamarack & Chesapeake Mining Company.

Professor R. B. Brinsmade left Morgantown, W. Va., recently for northwestern Ontario where he will examine some mines for West Virginia investors.

R. H. Wolff, New York, representative in the United States of the Heroult electric steel furnace, sailed for Europe June 22, to be absent about two months.

Cooper Shapley, of Guanajuato, has been appointed consulting engineer for the Mexican Mining and Smelting Company, at Tapalpa, in the State of Jalisco, Mexico.

S. H. Brockunier has just completed an examination of the Erie and Ancho mines near Graniteville, Nevada county, Cal., and has returned to his home in Wheeling, West Virginia.

C. G. Memminger, Lakeland, Fla., vice-president of the Coronet Phosphate Company, is spending a few days in New York, prior to sailing for Europe, where he will spend several months.

J. B. Stewart, formerly of El Oro and Guanajuato, Mexico, has joined the Constant-Herzig Company and will be in charge of the metallurgical department, making a specialty of cyanide work.

S. F. Shaw, general manager and consulting engineer for the Montezuma Mines of Costa Rica has gone to Costa Rica, where he will be engaged for some months in starting operations on the mines.

Professor Willett G. Miller, Provincial geologist of Ontario, has returned to Toronto from the Porcupine district, where he has been in charge of a party engaged in making a geological map of the area.

Oberbergrath Schneider, director of the *Bergakademie* at Freiberg, is to visit the United States, arriving on June 28. While in this country, his address will be in care of H. A. Keller, 45 Broadway, New York.

John Knox, Jr., in charge of the underground work for the Calumet & Hecla Mining Company, has returned to the mine after an extended sojourn in the South where he has been for the benefit of his health.

E. C. Engelhardt has resigned his position with the Mary Murphy Gold Mining Company, at St. Elmo, Colo., and has been appointed superintendent of the Cooke Mining and Reduction Company, at Cooke, Montana.

Edwin H. Messiter is no longer with the Robins Conveying Belt Company and is now in a position to take up special problems connected with the handling of material in metallurgical plants. His address is 25 Broad street, New York.

Frank H. Probert left Los Angeles, Cal., June 14, for a trip to Bisbee and Globe before continuing his journey on to Boston and the New York offices. From New York he expects to make a geological examination of the Potosi lead district in Missouri.

William Martin, late United States consul general at Hankow, China, has arrived at Seattle as the representative of the Hankow iron interests, which recently made a contract with the Western Steel Corporation for iron ore for the steel plant at Irondale, Washington.

Frank H. Crockard, vice-president and general manager of the Tennessee Coal, Iron and Railroad Company, delivered the dedicatory address, May 30, at Comer Hall, the new building of the engineering department of the University of Alabama. Dr. Joseph A. Holmes, of the United States Geological Survey delivered the address at Smith Hall, the new building of the geological department and museum of the Alabama Geological Survey.

OBITUARY

Charles A. Starne died at Springfield, Ill., June 4, aged 60 years. He was born in Pike county, Ill.; when 20 years old he was employed by his father in opening a coal mine near Springfield, one of the early mines in that district. Ever since that time he had been a mine operator and manager. At the time of his death he was general manager of the West End Coal Company and president of the Barclay Coal and Mining Company.

Elisha P. Wilbur died at Alexandria Bay, N. Y., June 4, aged 77 years. He was born at Mystic, Conn., and in 1852 he went to Mauch Chunk, Penn., where he was employed in the engineer corps which was surveying the line for the Lehigh Valley road. Later he became secretary to Judge Asa Packer, president of the company, and was closely associated with him until his death, when he became a trustee of the Packer estate. He was president of the Lehigh Valley Company for 10 years. He was also at one time one of the largest stockholders of the Bethlehem Iron Company, president of the Coplay Iron Company, and director of the Northampton Iron Company. He had large coal interests, being president of the Jefferson Coal Company, and the Packer Coal Company, and president of the Wilbur Coke Company, owning 30,000 acres of land in West Virginia, and a director of the Valley Coal and Coke Company, of Belington, in the same State. He leaves a widow and seven sons.

George W. Hughes, one of the pioneers of the Slocan mining district, of British Columbia, died at Portland, Oregon, June 14, having been ill with paralysis about three years. He was 51 years old and unmarried. Prior to 1892, in which year he went to the Slocan, he was engaged in railway construction work in northeastern Washington and the neighboring country. He took with him a pack train of 40 mules to transport ore from Slocan mines to Nakusp, on the Columbia river. Afterward he took a prominent part in building a wagon road to Kaslo, over which he hauled much ore from the Washington, Freddie Lee, and other Slocan mines, until the construction of the Kaslo & Slocan railway. Later he became manager of the Alamo and Idaho mines, and afterward owned the Sunset group and part interest in the Mountain Chief, Apex and Mammoth mines. He also acquired the Lucky Jim group, the chief producing mine in British Columbia. All these mining interests he sold after he became unable to supervise their operations personally. His body has been taken to Delta, Penn., for interment.

SOCIETIES and TECHNICAL SCHOOLS

Massachusetts Institute of Technology—Professor Robert H. Richards left Boston June 10, on a summer school trip with his mining students. He was accompanied by Professors Bugbee and Hayward, both of the mining department. The party will go to Buffalo, and from there take an ore steamer to Duluth. They expect to visit the Michigan copper region at Keweenaw Point, the nickel mines at Sudbury, and finally, the silver mines at Cobalt, Ontario.

EDITORIAL CORRESPONDENCE

Reports From Our Own Representatives on Important Events From Many Important Mining Centers of the World

San Francisco

June 16—When the farmers of Shasta county about a year ago began an agitation against the smelting companies, to compel them to put in devices to prevent damage from sulphurous fumes, the committee which visited the Bully Hill smeltery at Winthrop reported unanimously that no complaints had been made against that particular plant. The timber near by had all been cut before the plant was built, and outside a radius of two miles no damage to plant life could be noticed. On March 12, however, the Bully Hill company received notice from the U. S. Forest Bureau that a smoke-consuming device must be put in so that no damage could be done to timber in the Shasta national forest. The device was ordered to be put in within 90 days, though subsequently 20 days more were allowed, the limit date now being July 2. No such notices were needed for the Mammoth plant, at Kennett or the Balaklala, at Coram, as they are under contract with the Shasta County Farmer's Protective Association to install and begin the use of smoke-consuming devices by July 1. It is contended that there is much less sulphur in the smoke from the Bully Hill than from the other smelteries in the county, and the officers of the company are still negotiating with the federal officials. If the Government insists on its present position, it is probable that the Bully Hill smeltery at Winthrop will be closed.

Similar action on the part of the Government resulted in the closing of the extensive smelting plant of the Mountain Copper Company, at Keswick, some years ago, and that company erected a new smeltery on the shores of Suisun bay, above Martinez. The Bully Hill company is now negotiating with the other smelters to treat its ores.

The corporation known as the Champion Gold Mining Company, which took over the Champion mine at Nevada City some months ago, has been attached by the South Yuba Water Company for $1400 due for water and a lien has been filed on ore extracted for wages due the miners. As this company has not complied with the terms of the agreement with the Champion Mines Company, property reverts to the latter company.

The finding of the upper oreshoot in the Tightner mine at Alleghany, at 648 ft. below the old workings and 1650 ft. from the mouth of the tunnel, is considered important.

Denver

June 19—The Conundrum vein, which is really a mineralized basalt dike on Gold hill, Cripple Creek, has been in the past celebrated alike for its rich ore and the foul gases which prevented the proper exploitation of the same. By the installation of a ventilation process, operations have been successfully resumed at the 900, or lowest level, by Worcester, the lessee, and a 10-ft. orebody has been discovered, which averages about $50 per ton in gold. The Conundrum, Mary Ann, and Ethel Louise claims belong to the Ethel Louise Mining Company.

Beacon hill, the mines of which are soon to be unwatered by the Roosevelt deep drainage tunnel, is again to the fore with an extremely rich discovery in the Prince Albert company ground by Edward Cookerly, lessee. The ore is said to be petzite, and the width, 14 ft. Assays just taken run from $18 to $300 per ton in gold. Another shoot lately uncovered between the Prince Albert and the Black Belle, by the Union Leasing Company, is said to be 3½ ft. wide, and averaging about $30 per ton in gold. The drainage tunnel is expected to be under these mines, and the El Paso mine by September, when it is planned to have a formal opening, at which Mr. Roosevelt is expected to be present. The success of this tunnel will mean an enormous amount of additional orebodies made available and will be a great object lesson to other mining communities in the matter of coöperative drainage.

Butte

June 18—Persistent rumors concerning the financial difficulties of the Butte & Superior Copper Company have served to depress the market quotations. While mining has been going on as usual, no work is being done on the concentrator. The best obtainable information, while not authentic, is to the effect that the present capitalization of 1,200,000 shares of the par value of $5 will be changed so that the shares will number 600,000 and their par value will be $10 each. The former $400,000 bond issue will be retired and a new $1,000,000 issue authorized. Apparently, the deal with the American Metals Company, by which that company agreed to furnish funds for the construction of the zinc concentrator, has miscarried or else the public has been misinformed as to the tenor of that agreement. The situation contains many puzzling features for there seems to be no question but that the property contains valuable deposits of zinc ore, which can be worked at a profit.

Alexander Fairgrieve, president of District No. 27, United Mine Workers, has recently made the statement that when the wage-scale conference meets at Billings, Aug. 23, the Montana coal miners will demand a wage increase of 5½ per cent. over the present scale, in conformity with the demand for increases throughout the country.

Salt Lake City

June 18—A new power plant is being built in Sevier county in the south-central part of the State by the Belnap Power Company. The plant, when completed, will generate 9000 h.p. The company controls 1519 acres along the Sevier river, between Marysvale and Sevier, on the Denver & Rio Grande. There is a fall of 329 ft. in the part of Sevier cañon, controlled by the company. The plant will be built in sections. Work is now under way on the first unit which will furnish 1500 h.p. A 1400-ft. tunnel is being driven through the neck of Horse Shoe bend, near Sevier, which will obviate flume and canal construction and reduce the cost of maintenance. A power plant will be built at the north end of the tunnel and will furnish electricity for the towns of Joseph, Elsinore and Richfield. Should there be enough demand, a line will be extended south from Sevier to supply the Marysvale and Gold Mountain mining districts. William Seegmiller, of Richfield, is president of the company, William Johnson, treasurer, and J. B. Weimer, manager.

Miners' Day was celebrated at Salt Lake and Lagoon, June 13. About 2000 miners and their families, from Park City, Bingham, Mercur, Stockton and Tintic took part. Bingham sent about 900, the largest representation, while Tintic was second, with 700. Two special trains were run from Tintic, over the Salt Lake route, and the Bingham miners had two trains of their own over the Rio Grande. There was a parade in the city in the morning, and a baseball game and various amusements at Lagoon in the afternoon.

Articles of incorporation of the Bonneville Mining Company have been filed by the Knight interests. The capital stock is $100,000, based on the valuation of mining property in the mountains be-

tween Provo and Springville. A long tunnel will be driven about three miles southeast of Provo to prospect for mineral and water. Work on this tunnel has been started. The officers of the company are: Jesse Knight, president; J. William Knight, vice-president; R. E. Allen, secretary and treasurer.

Goldfield

June 18—In pursuance of its policy to eliminate as far as possible danger of accident or injury to its employees, the Goldfield Consolidated has organized an inspection department. While timbering and ventilation in the property are excellent, it is planned to better these conditions, if possible, by adopting all reasonable and practical precautions for safety. Hoists, cages, shafts, ladderways and timbering as well as other machinery on the surface are regularly inspected and notices have been posted urging the employees to offer any suggestions. The elaborate system of fire protection being installed in part of the general plan and will be under the supervision of the inspection department.

M. J. Smith, an assayer, was convicted, June 8, on the charge of stealing gold-bearing amalgam from the Consolidated mill. It was alleged that Smith approached an amalgamator and that a conspiracy involving a watchman at the mill and a peace officer and saloonkeeper in Goldfield was formed. The mill men turned "State's evidence," Smith has been found guilty by the jury and the others are under indictment awaiting trial.

The management of the new consolidation, Nevada Hills-Fairview Eagle, has given notice of a new and reduced wage scale. The union has decided that nothing could be gained by resistance, so the new scale, the same as in Goldfield, will be accepted.

Buckhorn, the new camp in Eureka county appears to have good possibilities. It is claimed that the ore can be mined with steam shovels. George Wingfield has been developing the property and is planning a cyanide plant.

The Lemon mill at Manhattan, which has been idle for four years, has been sold to J. V. Priest, representing eastern capitalists. The sale clears up the litigation and the mill will be placed in commission at an early date. The other plants in the vicinity are now unable to handle all the custom ore.

Toronto

June 18—The output of the Canadian lead mines for the fiscal year ended March 31 was the largest for several years, as indicated by the returns of bounties paid on lead ore delivered at Canadian smelteries. The bounty now amounts to $15 per ton of lead on a sliding scale based on the London price of lead. The payments last year were $340,542 representing 45,467,545 lb. of lead, as compared with $307,432 for 42,533,287 lb. the year previous.

W. J. Bauldry, the expert engaged by the Temiskaming & Northern Ontario Railway Commission to make investigations as to the alleged discoveries of coal deposits on the Metagami river, in northern Ontario, reports that no coal has been found. Lignite occurs in some quantities but the known amount is not large and its value problematical. There are large deposits of iron ore in the district which will yield as high as 50 per cent. iron.

Dawson, Y. T.

June 6—The opening of the Yukon river is creating great activity in the Dawson camp. Machinery is coming in and placer, quartz and coal operations are being exploited extensively. The opening of coal properties is one of the most important of all the projects this season. With the enterprises under way it is expected that by the end of the season the coal promoters will have the product on the market. The Tantalus mines, which are being exploited by St. Paul capital have been prospected all winter, and a new seam of coal 9 ft. thick has been struck. This seam is on the Tantalus Butte property, owned by the Five Fingers Coal Company. The Northern Light, Power and Coal Company is continuing prospecting and development on its Coal Creek properties, and expects to have 2500 tons of machinery for its lower plant here early in the season. Frank Morrison will continue prospecting his coal properties on the Klondike with diamond drills.

A. N. C. Treadgold is installing a large power scheme on the Klondike river, and has taken over much ground on Dominion and Quartz creeks.

A three-mile spur has recently been completed to the Jackpot mine, one of the British Columbia Copper Company properties. The Jackpot first week shipments amounted to 480 tons, and the tonnage will increase according to the requirements at the smeltery. The ore averages from $7 to $9 and the property promises to become one of the important producers in the Boundary district.

Johannesburg

May 10—The share market in Rand stocks has been quite neglected during the last few months largely owing to the increased speculation in rubber and oil shares. The chief reason is, however, that most of the stocks do not at present prices present attractive investments when the question of amortization of capital is considered; 12½ per cent. is about the highest yield at present available and a mine like the East Rand Proprietary with a large area of unworked ground and a possible long life of 30 years yields only 7½ per cent. When disappointments owing to falls of grade and other causes have to be set against possible increases in profits due to possible future reductions in working costs the investor prefers to buy rubber or oil shares which yield 10 per cent or over with prospects of higher returns and in the case of rubber lands a permanent investment

The visit of Mr. Marriott has been followed by a rise in grade and in the profits earned by several mines and now there are signs that the directors of the Rand mining industry may decide to work the rich ore first. Mines are already stopping the working of stopes assumed to be unpayable and hanging up stamps. Just how far this will be a genuine reaction from the practice of sending up waste or unpayable ore to keep the mills going will depend on quite a number of factors and the factor of policy is an unknown one. Since Mr. Marriott's visit and the charges he laid against the wisdom of the system of mining as those prevailing on the Rand several important charges in the administrative staffs in the head offices and on the mines have been carried out and it is said that the members of the American colony have been the heaviest sufferers.

A serious accident on the Cinderella Deep which is stoping below 4000 ft. has given warning of the dangers to be met with in attempting to work mines at this depth in the open stopes and pillar system which has so long prevailed in the older and shallower mines. The warnings that might have been derived from the fate of the Atlantic mine in the Lake Superior region have so far been disregarded and the dangerous condition of some of the outcrop mines is only now forcing the administrations to start sand filling. Seventeen natives were killed and several injured by an "air blast," as the official report describes the accident. At 4000 ft. theoretically 50 per cent. of pillars would not be sufficient to support the roof.

It is highly probable that in these deep mines sand filling will be introduced into the workings by means of low-pressure compressed air and that the sand will be subsequently wetted and packed in place. In this way the difficulty and expense of dealing with large quantities of water will be avoided. Dry sand forms a particularly favorable filling to be transported by air. It will be remembered that the experiments at Kattowitz in Prussia were carried out with filling the size of pigeons eggs and naturally higher pressures had to be employed. The fact that most of the slimes have been separated from the sands would also render the grains more mobile and prevent packing.

It is unofficially stated that the prize for the stope drill competition will be divided between the Holman and Siskol drills with the Chersen second.

THE MINING NEWS

Reports of New Enterprises, New Machinery, Installations, Development Work and Property Transfers The Current History of Mining

Alaska

Alaska Mexican—For the month ended May 15 the ore crushed was 17,929 tons of an average yield of $3.09 per ton. The total production was $55,508 and the net operating profit $24,610.

Alaska Treadwell—For the month ended May 15, 68,488 tons were crushed, averaging $2.56. The total product was $175,506, and the net operating profit, $78,806.

Alaska United—For the month ended May 15, the Ready Bullion and the "700" mills crushed respectively 18,970 and 15,797 tons; yielding respectively $39,809 and $32,504; with a net operating profit of $12,435 and $7634 and a yield per ton of $2.10 and $2.06 respectively.

Arizona

Cochise County

A general lessening of the water in the Bisbee mines is noted, presumably due to the continued drought.

The Whitetail mine near the Bisbee-Sonora is being developed as is also the Leadville. The Sullivan is still idle. Many claims have been located in Whitetail cañon.

Bisbee-Sonora—This property in the Chiricahua mountains will install machinery. About 1000 ft. of development has been done.

Gila County

Old Dominion—The output for May was 2,150,000 lb. of fine copper. The output for June is expected to be about the same. Three blast furnaces are in operation. George Kingdon is mine superintendent.

Live Oak—Drill hole No. 5, 1100 ft. west and 300 ft. south of the shaft, encountered chalcocite ore averaging 2½ per cent. copper, at 320 ft., and is still being sunk in the ore 425 ft. from the surface. This is the sixth hole on the land, penetrating the orebody, No. 6 having passed through 100 ft. of ore some time ago. Hole No. 5 is 1100 ft. west of the shaft, where the orebody was first penetrated, and 300 ft. south of it. Hole No. 7 is 700 ft. south of the shaft and 300 ft. west of it. On the 200-ft. level of the mine, drift No. 208 has been driven continuously eastward through ore of good grade for 235 ft. Drift No. 207, driven southward from drift No. 208, has passed through ore for 34 ft. M. E. McCarthy is manager.

Superior & Boston—The McGaw, the main working shaft of the property, has been sunk 163 ft. below the sixth level. The west winze sunk from the 400-ft. level of the Gardner workings is still going down in ore averaging 8 per cent. copper. This winze is being sunk at an angle on the Black Oxide vein. Regular shipments of 9 per cent. oxidized copper ore are being continued from the Great Eastern vein at the rate of two carloads daily. John D. Wanvig is superintendent.

Venture Exploration—A force has been put at work on the property recently acquired from the Gibson Copper Company by the Venture Exploration Company.

Santa Cruz County

Bland and Kangaroo—What bids fair to be an important discovery has been made by T. M. Heck in sinking a joint shaft for these mines. A point of ore was encountered at 15 ft., which rapidly widened, making at 25 ft. a body of sulphide ore about 3 ft. wide and running 10 per cent. copper and $20 in gold and silver. The ore, when first met, was indigo copper and at 1 ft. of thickness ran 50 per cent. copper. This is the first find reported of covellite in the Santa Ritas in commercial quantity. Mr. Heck has taken out 300 tons already and has commenced hauling to Patagonia.

Augusta—Hoval A. Smith is making an examination of this copper mine, from which heavy shipments were made last winter. This is a pyritic ore, running from 3 per cent. up.

Wandering Jew—Work done by R. R. Richardson, of Patagonia on this mine disclosed lead in the shaft 3 ft. wide at 140 ft. In the east drift on the 200-ft. level, a copper-silver was found at 40 ft. from the shaft. The work is still in this body of ore.

Silver Cañon—Josiah Bond has bonded this group for $25,000, and work will begin on a deep shaft. The ore here is a high-grade silver ore.

Four Metals—This mine at Turkey flat has changed hands and it is stated now belongs to copper men of New York, who are considering opening the mine on a large scale, including mill and railroad to connect with the Southern Pacific near Calabasas. There was excitement at this mine last year when a large body of low-grade copper ore was penetrated by tunnel. The ore was cubanite and in the crosscut had a tenor of 2 to 3 per cent.

Gila County

Pulaski—Martin Michelski has opened carbonate ore on this mine in the Josephine cañon.

Yuma County

Silent King—This group in the Alamo mountains is being developed by Llewellen Humphries, of Salt Lake City. Machinery will be installed.

Arkansas

The Willis zinc property in Boone county is being developed by J. H. Dickerson, of Harrison. The Tar Kiln company, Thomas Malone, manager, is erecting a concentrator.

California

Amador County

Monte de Oro—The 10-stamp mill erected at this mine, Plymouth, by A. F. Morgan, will operate.

Solano—This gold company, owned by C. and B. F. Reams, has recently purchased from J. Acosta a gravel claim north of Rolan Volcano and will begin work on it.

Butte County

Butte Star—E. C. Wilson has sold the controlling interest in this property near Nimshew to G. W. Cramer, of Germantown, Penn. The gravel channel in the mine is tapped by a 3000-ft. tunnel.

Calaveras County

Copa de Oro—This company, working on the south bank of the Mokelumne river, has run a tunnel 425 ft. under supervision of Alex Ransom. A mill and cyanide plant will be erected.

Eldorado County

Good Luck—This mine in Diamond Springs district is being worked by William Mitchell and the miners are in a payshoot from 16 to 24 in. wide. There is a 5-stamp mill.

Big Buzzard—This mine is being opened at Negro hill, a few miles from Folsom, by L. Darrington, George Darrington and Joseph Forster.

Humboldt County

Klamath—Extensive improvements have been made by this company on its hydraulic mine at Weitchpec. C. A. Sample is in charge.

Inyo County

Bishop Creek—Work on this property has been resumed and the water has been lowered to the second level.

Cold Storage—At this new camp D. C. Adamson has found a rich vein a mile

west of the Golden Siren. At the latter mine a tunnel is being run up to tap the vein in the shaft. The owners intend erecting a mill.

Casa Diablo—This mine, 20 miles north of Bishop, has a 30-ton mill which will be enlarged.

NEVADA COUNTY

Wisconsin—This mine at Graniteville is being reopened under charge of Fred Medlin. Hoisting and pumping machinery will be put in.

Powning—This Grass Valley mine has been placed under bond to C. D. Tregoning, who will develop it.

PLACER COUNTY

Imperial—The Central Mines and Development Company, of Uniontown, Penn., has been organized to purchase this mine near Michigan Bluff.

PLUMAS COUNTY

Negotiations are going on with the Western Pacific railway to induce it to build a spur into Mohawk valley where San Francisco men connected with the Anglo-California bank own an iron-ore deposit.

Salmon Falls—This placer claim near Seneca has been bonded by G. H. Goodhue and others to Dr. C. I. Burt.

Del Monte—J. J. Reilly has made payments on this mine and has 15 men at work.

SHASTA COUNTY

Evening Star—This property at Old Diggings, under control of German capital, is shipping 400 tons of ore monthly to the smelteries.

Victor—The 20-ton Nissen mill has arrived at Harrison gulch.

Sibyl—The French Gulch Mining Company at French gulch has taken a two-year lease on this mine at the same place.

SIERRA COUNTY

Von Humboldt—This mine at Alleghany, idle for 12 years, has been bonded to F. B. Smith and J. J. Guentherodt and will be started up under Frank B. Smith.

Amethyst—This mine at Forest has been bonded to men from San Francisco and Alameda. A. C. Wilkinson, Oakland, is manager.

SISKIYOU COUNTY

Yreka—The custom quartz mill at Yreka will be moved to Forks of Salmon.

TRINITY COUNTY

D. B. Fields has bonded to Dr. B. E. Stevenson and J. A. Manaudas, of Redding, his placer and quartz claims in Indian Creek, Pauwauket and Douglas City districts, together with ditches and pipe lines. The new company will commence active work on the lower placers.

Headlight—A 40-stamp mill is being built for this mine near Carrville.

TUOLUMNE COUNTY

Old Dominion—Grant & Rowse have found a rich pocket in this mine near Columbia.

Longfellow—This mine, at Big Oak Flat, has resumed under supervision of Frederick Meyer.

Colorado

BOULDER COUNTY

Colorado-Arizona—This company is erecting a 50-ton mill at Magnolia.

Morning Star—This mill at Ward has started treating ore from the 300-ft. level. Clifton H. Skidmore is in charge.

GUNNISON COUNTY

Elk Mountain—This company is developing the Mountain King. A water-power installation will be made. J. T. Bennett is superintendent.

LEADVILLE—LAKE COUNTY

Sawatch—This tunnel, in the Sugar Loaf district, on which work was commenced a year ago, is now in 1200 ft., and is being advanced 200 ft. per month. The plant is operated by electric power from the Central Colorado Power Company. About 800 ft. remains to be driven before reaching the objective vein series. North Carolina capital is interested. J. F. Horner is the manager.

Lovejoy and Steel Springs—These tunnels, on Printer Boy hill, have each been driven 700 ft., and have been producing much ore during the last few months under the management of J. C. Hersey.

Clear Grit—This mine, on Long & Derry hill, and largely owned by Charles J. Moore, of Denver, is to be reopened. An electric plant is being installed, and the old shaft will be sunk. It is believed to be in line with the orebodies of the Houston and other mines, and generally conceded to be a property of promise. C. J. Moore is also working the Ella Beeler.

SAN JUAN DISTRICT

Revenue—This mine in Sneffels basin will put on an additional force. It is interesting to note that this mine, like the Camp Bird, showed silver-lead ore on the surface, while at 2000 ft., it is producing largely in gold.

Camp Bird—The company's quarterly report says: "Everything in development work so far points to the fact that the second level horizon is too low."

TELLER COUNTY—CRIPPLE CREEK

Jerry Johnson—This mine, on the north slope of Ironclad hill, is once more in rich ore, and the mill, erected by the lessee, Edwin Gavlord, at the mine, is treating 50 tons daily besides what goes to the Valley mills and the smelteries. The W. P. H., which lies 100 ft. to the north of the Jerry Johnson, is also said to be in "bonanza." A year ago these properties were supposed to be worked out. Both these veins are entirely in the breccia area.

Free Coinage—The Wilson and the Reed & Van Tilborg leases have opened an oreshoot on which they have drifted already 15 ft. There is a seam of free gold on the footwall which is being sacked. There are 15 sets of lessees at work on the Free Coinage company, and carload shipments are yielding from $20 to $45 per ton in gold.

Idaho

CŒUR D'ALENE DISTRICT

Cedar Creek—Two feet of shipping galena ore was broken into in the face of a 1000-ft. crosscut tunnel recently. The property lies near the Hercules mine and the strike is considered one of the most important in the district for the last year.

Monarch—The company has sold to the Cœur d'Alene North Fork Mining and Smelting Company the Monarch mine, a lead shipper, for $175,000.

Indiana

SULLIVAN COUNTY

The County board of review has practically decided to allow a deduction each year from the valuation of mining property for coal actually mined during the year. This action comes after solicitation of representatives of the Alliance, the Consolidated Indiana and other coal companies. This has been the rule in all the Indiana coal-producing counties except Sullivan.

Thomas J. McAnally, of Jackson, has filed suit against the Consolidated Indiana Coal Mining Company for $39,000, alleging that the company mined 19,000 tons of coal from under his farm without his consent. The suit is regarded as of great importance.

VIGO COUNTY

The joint scale committee of district No. 11 has been at work making a permanent contract for six weeks. The more troublesome questions were easily and satisfactorily settled, but the mine workers and operators have split on the firing clause. The miners, however, will probably continue to work indefinitely under the temporary agreement.

Kansas

Diplomat—This company, A. L. Gains, superintendent, has completed its new mill at Galena.

Mess—This company, at Galena, has made a most phenomenal strike on the land of the Glick Land and Mining Company, west of Galena. A 20-ft. face of lead ore was disclosed at 80 ft. in one hole and about the same amount of blende in several other holes. The shaft has been sunk through the deposit.

Lockport—The mines of the company at Galena, which were flooded by the

overflow of Short Creek bottoms, are being drained again with the help of large pumps.

Kentucky

Cumberland Mining Company—This company has been formed at Burkesville to develop zinc-lead leases on 25,000 acres along the Cumberland river. Operations have been begun at Otia, Monroe county.

Michigan

Copper

Wyandot—The drill operating from surface to cut the lode on which the exploratory shaft was sunk has reached 220 ft. The crosscut from the bottom of the shaft continues eastward toward the Baltic and Lake lodes.

Wolverine—This company has started drill operations to ascertain the mineralization of the Osceola lode on its lands. The exploratory crosscut driving eastward from the 28th level is making good progress.

Algomah—The company has started sinking on the site of the recently exposed ore.

Lake—Preparations are being made to start crosscutting to the lode from the seventh level of the shaft. The pitch of the shaft is being changed to conform more closely with that of the formation. Excavating for the permanent surface equipment is under way.

North Lake—No. 8 drill exposed a felsite formation carrying copper in silicates and oxides at 550 ft. The core resembles that taken from the No. 2 hole of the Indiana at 1400 ft., with the exception that this core carried native copper.

Keweenaw—The company has discontinued drilling from the bottom of its Medora shaft after penetrating the Osceola amygdaloid and the Calumet conglomerate lodes, both of which carried a small amount of copper. The sinking on the Kearsarge lode is down 225 ft. in the hanging wall. At the 150-ft. level a crosscut was extended to the footwall showing the lode was charged with copper. This lode has been exposed at 1400 ft. by a drill put down in line with this shaft.

Mass—Preparations have been about completed for the resumption of sinking at "C" shaft, which has been bottomed at the eighth level for some time.

Missouri

Center Creek—This company has decided to drill its land at Webb City and Carterville and prospect for the deep ore. There has been a production of about $14,000,000 from the upper levels of this land and it has been worked only to 170 ft. Neighboring mines have been worked to 250 feet.

Mandarin—This company has made a rich strike in a drill hole from the 42-ft. to the 97-ft. level. A new shaft will be sunk.

Mary E.—C. C. Playter has completed the mill at this mine at Spring City. This prospect has some of the richest ore in the district.

Joplin-Webb City Consolidated—This company has taken over the Minor Heir mine and lease at Webb City.

Lone Star—This company operating near Knights Station has uncovered a 6-ft. face of lead ore in the mine at 14 feet.

Montana

Butte District

Davis-Daly—The assessment on all issued stock is to provide money for continued operations. The operating expenses are $10,000 per month and with less than $50,000 in the treasury funds will soon be needed. The injunction proceedings against the company, which have prevented it from building a tramway from its Colorado shaft to the Great Northern tracks have been appealed to the supreme court and until a final decision has been reached no shipments will be made. On the 1400-ft. level of the Colorado there is a body of smelting ore blocked out while on the other levels from the 1000 to the 1500 the ore is of concentrating grade.

Butte-Ballaklava—Superintendent Newton says, "The ore is widening and improving in the 900 west shoot. We are running on the 800 level which continues rich. On the 700 we have 4 ft. of 16 per cent. copper and 34 oz. of silver." President P. H. Nelson has returned to Duluth.

East Butte—The company has issued its annual report. On April 8, 1909, the East Butte and the Pittsmont companies entered into an operating agreement, which became effective Oct. 1, 1909, and since that time the East Butte company has been operating the properties of both concerns. During the six months previous to March 31, 1910, the company mined 3,645,220 lb. of copper, 106,485 oz. of silver and 882 oz. of gold, of a total value of $496,091, which, after deducting operating expenses, left a profit of $80,479. Of this amount $16,170 has been expended for new machinery and $43,915 for exploration and development.

North Butte—In connection with the dividend reduction from 50c. to 30c., the company says: "At the present time an extraordinary amount of development work is being vigorously prosecuted in the mines. Two shafts are being opened, development work on both Edith May and Jessie veins prosecuted on 2000- and 2200-ft. levels and below the 2200-ft. level on the Edith May as well as extensive development of the Crœsus claim the remaining part of which was recently secured and of contiguous property. This development work is disclosing additions to the ore reserves in the mines. The winze below the 2200-ft. level of the Edith May still continues to disclose high-grade ore and the development work on Crœsus claim and contiguous property is disclosing ore of excellent grade. In view of the development and additional expenditures required for this purpose, the directors deem it prudent at this time to declare a dividend of 30c. per share."

Cascade County

In the Neihart district the Snow Creek company has several tons of ore on its dump and will start its mill. Leasers on the Whippoorwill property have started making shipments, while Kavanaugh, Bronson & Weiberg have made one shipment from the Spokane mine, and will make regular shipments in the future. At the Ripple mine the lower tunnel is close to the oreshoot which produced high-grade ore through the upper workings. On the 200-ft. level of the Broken Hill mine John McCooey has cut profitable ore and will begin shipments. On the Tom Hendricks claim Lenny & Co. have struck ore, which has greatly encouraged prospectors in the district.

Fergus County

Cumberland—The mill has proved entirely satisfactory, and ore from the Cumberland and from the Spotted Horse will be treated.

Granite County

Hidden Lake—After a test of the stamp mill, the results of this treatment have been found to be unsatisfactory, and operations will be curtailed until some effective method can be found.

Lewis & Clark County

A fire, starting in the dust at the bottom of the baghouse at the East Helena smeltery, consumed the bags and partially destroyed the wooden stacks which convey the fumes into the open air. Thirty men employed at the sampling works went out on a strike, June 8. The men are seeking an increase in pay from $2 to $2.25 which Manager F. M. Smith has not as yet conceded.

Old Dominion—A recent shipment of 20 tons to the East Helena smeltery netted Daniel Dutro, who is working the property, $1400. The value of the recent shipment was principally in gold, whereas for 40 years the principal metals have been silver and lead.

Madison County

The five-stamp mill on the Pritchett property in Bear Gulch has been in operation for several weeks. The lessees of the Carolina mine at Goodrich gulch have received returns from a recent shipment giving $93 per ton. The Empire Exploration Company has encountered ore running from $20 to $25 per ton on its Pacific claim. The American Goldfields Placer Mining Company is push-

ing operations on its property near Goodrich gulch.

Winnitka—The company, organized by D. J. McGrath, Arthur Tullock and F. C. Ball, of Butte, owns gold claims 4½ miles south of Virginia City. The property is being worked by a tunnel in 150 ft. A new tunnel will be started.

MISSOULA COUNTY

Bryan—This property will resume operations. Much lead-silver ore has been exposed and a mill is planned for this summer.

POWELL COUNTY

Victor—The property is four miles from Ophir and consists of three gold quartz claims. A shaft has been sunk 150 ft. and about 1500 ft. of crosscuts and drifts run. A mill test of ore on the ground gave $20.80 to the ton.

MISSOULA COUNTY

In the Saltese and Carter districts considerable activity is being shown. At the Ben Hur, near Saltese, while running a raise from the lower tunnel a 6-ft. vein of solid galena was encountered. Shipments will be begun at once. At the Monitor mine the pumps have been put in commission and preparations are being made for shipping. The Iron Mountain company has recently cut a vein of shipping galena in the lower level, and the development of the zinc vein is being pushed. Joseph Carson has secured a lease on the Little Pittsburg mine, and will begin operations. The Carter Mining and Milling Company is ready to begin shipments. At Hamilton-Cœur d'Alene mine the tunnel, now in 300 ft., will be driven another 200 ft. to tap the ore in the shaft.

Nevada

ESMERALDA COUNTY

Goldfield Consolidated—Preparations are under way for "glory-holing" the Combination vein system from the 400-ft. level to the surface. Rich milling ore will be extracted along the vein nearly 1000 ft. through the lower workings of the old Hampton stope which are in readiness to commence the work. Application has been made to the New York Stock Exchange for the listing of 3,559,148 shares of the capital stock of the company, which represents the outstanding stock of the company. The authorized capital is $50,000,000, the par value $10.

Combination Fraction—The orebodies on the 500, 750 and intermediate levels are being developed rapidly to supply the mill with 75 tons daily.

HUMBOLDT COUNTY

Donald Ferguson, of Goldfield, has purchased five claims owned by Frank Snapp, of Rebel Creek, Nev., and the Wells-Fargo company in the New Goldfields district south of National. The property is low grade.

National Consolidated—A bullion shipment of $83,000 has been made from the Stall lease. J. H. Cansten, of Eureka, has taken an adjoining lease.

LANDER COUNTY

Buckhorn—George Wingfield has given an option to Aug. 1 on his property south of Battle Mountain, for $3,000,000, to the United States Mining Company, of Salt Lake City. It is reported that the mine has $2,000,000 worth of ore blocked out.

LINCOLN COUNTY

Yellow Pine—The 50-ton mill in the Goodsprings district is being built. The grade for the railroad from Jean to the mill is ready for the rails.

NYE COUNTY

Mizpah Extension—This group is to be extensively developed. An 800-ft. shaft already sunk, will be deepened and lateral work commenced.

Tonopah-Belmont—The first semi-monthly cleanup since resumption of mill operations, produced $20,000 in bullion and $12,500 in concentrates.

Tonopah Extension—A new 82-h.p. electric hoist will replace the old steam installation.

Tonopah—The Red Plume ore bins are ready to handle the tonnage from the western portion of the mine, eliminating much training.

New Mexico

GRANT COUNTY

Chino—Hayden, Stone & Co. say: "The May report shows an increase in the developed ore of 849,512 tons; the grade remains practically the same. There was no change in the tonnage of partially developed ore. The total of the fully and partially developed ore now stands at 18,798,078 tons, consisting of 8,725,091 tons of fully developed ore, and 10,072,967 tons partially developed ore. The average grade is 2.59 per cent. The ore is in half a dozen different bodies scattered around the rim of a semi-circle. The development of the last two or three months has been with the idea of determining the continuity of the ore between these bodies. The drill map would indicate that practically continuous ore now extends around the entire eastern half of this semi-circle. The assays from the underground workings give considerably higher returns than do those from the drill holes. In 16 holes where the underground workings have coincided with the drill holes, the average assay from the raise has been 2.50 per cent. as against 2.07 per cent. from the drill hole."

OTERO COUNTY

The pipe line conveying water from the Sacramento mountains to the Orogrande district has been sold to the El Paso & Southwestern railroad with the rights to the water, which has created the impression that the copper smeltery at Orogrande will be abandoned, as the water was taken in for the purposes of the smelting company.

Knocker—An attempt will be made to work this placer, near Jarilla, using dry washers.

SIERRA COUNTY

Black Range Reduction Works—This company, backed by Colorado men, is building a custom mill at the new camp of Bullion, in the Black Range district. The company has purchased a number of properties in the district and is working a force of 18 or 20 men.

El Paso Home Mining Company—Financial difficulties have overtaken the company, operating at the Grafton camp and the unfinished mill of the company is threatened with attachment for labor. The company forfeited on the Ivanhoe property, after one or more payments had been made.

Oklahoma

A far reaching decision of the Federal Circuit Court of Appeals just made will affect the mining industry of the Miami and Quapaw camps to a great extent. This decision reverses that of the U. S. Circuit Court and holds that the Indians are still wards of the Government and that the Government control over their allotted lands has not been impaired by virtue of their allotment and citizenship. A great many suits brought by the Government are pending in the courts to set aside leases and transfers of land from the Indians to white men. The Government alleges that unfair advantage has been taken of the Indian and that he has not been given value received for his land.

Premier Petroleum Company—This company is being financed in London by the Anglo-Dutch Petroleum Company. The company has 3660 acres. J. E. Crosbie, Tulsa, is manager.

Oregon

DOUGLAS COUNTY

Billiken—This group on Cañon creek has been leased to Ockley & Barber, of Gold Hill, and development will be done.

BAKER COUNTY

Bonanza—A vein of free-gold ore has been uncovered and the company expects to make shipments.

Utah

BEAVER COUNTY

Majestic—The shaft was completed to the 600-ft. level May 31, and the drift has been started for the ore developed on the level above. Manager Moffat estimates that this drift will reach the ore at 235 ft. from the shaft and should be completed in 50 days. From this shaft he also estimates that he will cut two other fissure veins and he expects to develop three orebodies on this level. This

assessment of 5c. per share will provide $40,000.

Moscow—Drifting is being done on the 300-ft. level to reach the orebody which was opened on the 400, and a raise from the latter level will soon connect with this new work. The vein on the 400 has been drifted on for over 450 ft. A winze has been sunk from this level in ore for 135 ft. Regular shipments are being made.

Trisco Consolidated—The 600-ft. level east of the main workings is being driven for the limestone-andesite contact. Some low-grade copper ore has been cut in the last 20 ft. D. P. Rohlfing is manager.

Cedar Talisman—A raise 37 ft. above the 500-ft. level has developed ore, making out from the main fissure along the limestone bedding. The ore is 3 to 6 ft. in thickness, and carries galena, with some hornsilver. It has been opened for 25 ft. along the strike. The winze from the 500 shows the ore to be wider below this level. The company is making regular shipments.

Utah Mining, Milling and Transportation Company—An orebody has been opened recently in the Hub property owned by this company. The strike was made in the Lady Bryan claim, on the 200-ft. level, about 150 ft. from the shaft. Ore carrying principally copper, has been crosscut for some distance. The shaft is being sunk to the 300-ft. level and another crosscut will be driven for the orebody. Bins have been built and the roads put in shape for hauling to the railroad, a distance of six miles. About three cars of ore are mined.

Wild Bill—A body of lead-carbonate ore has been broken into on the 300-ft. level, about 100 ft. beyond the strike made two months ago.

Arrow Head—This company was recently organized to operate a lead property on Indian Peak. The capital stock consists of 1,000,000 shares of a par 25c. Roads are being built and preparations made to begin work. John H. Barton is president.

Juab County

Tintic shipments for the week ended June 10 were: Opohongo, 2 cars; Mammoth, 2; Lower Mammoth, 7; Victoria, 2; Grand Central, 8; Centennial-Eureka, 28; Bullion-Beck, 1; Chief Consolidated, 3; Gemini, 3; Iron Blossom, 22; Dragon Iron, 36; Brooklyn (lease), 1; Sioux Consolidated, 14; Colorado, 9; Scranton, 4; Iron King, 5; Eureka Hill, 2; East Tintic Development, 1; May Day, 4; Eagle & Blue Bell, 10; Uncle Sam, 7; Carisa, 1; total, 172 cars.

Colorado—At a meeting of the directors, held June 10, a dividend of 8c. a share was declared, payable June 20. The dividend calls for the distribution of $80,000. Up to date, the company has paid $2,130,000, or $2.13 a share, which came practically from one orebody. Sinking and prospecting at depth will be carried on in search of new ore. The company has ample funds in the treasury for this work.

Iron Blossom—A quarterly dividend of 6c. a share, or a total of $60,000, has been declared, payable on June 25. There has been an improvement on the 500 level of the No. 1 shaft. The gold orebodies on this level have increased in size and richness. About 20 tons are being mined here daily. The No. 1 shaft is 1640 ft. deep, and sinking is being continued.

Tintic Central—A change from white to blue limestone, showing mineralization, is reported in the shaft.

Beck Tunnel—The mine was closed down June 11. Development at depth has so far failed to disclose new orebodies. An assessment of 1c. a share was recently levied.

Uncle Sam—At the meeting held June 8, a dividend of 2c. a share, or a total of $10,000, was declared, payable June 20. The same dates apply for the distribution of 400,000 shares of May Day stock, owned by the company. Stockholders of Uncle Sam are to receive 80 shares of May Day for every 100 shares of stock held by them. This action is due to the necessity at the present time of assessing May Day stock, which would draw on the Uncle Sam treasury. The May Day stock was acquired through the sale of the Uncle Sam claim, including the present May Day mill to the May Day. The capital stock of the latter company was increased from 400,000 to 800,000 shares, and 400,000 shares given in payment for the property.

May Day—An assessment of 2c. a share was levied on June 9, delinquent July 15. The $16,000 from this assessment will be used for the purchase of heavier hoisting equipment and for sinking. The company has paid $108,000 in dividends, the last distribution being in September, 1908.

Sioux Consolidated—The lowest level is at 450 ft. Some low-grade ore was opened on this level, and a winze has recently encountered ore of better grade. Preparations are being made to sink the shaft.

Tintic Standard—Mineralized quartz has been cut in the shaft at 840 feet.

Salt Lake County

Wasatch-Utah—The mill recently installed to treat the ores from the Jefferson mine at the mouth of Little Cottonwood cañon, was placed in commission June 8. The ore occurs in a narrow fissure vein and carries gold and copper. About 375 tons of ore are on the dump.

Utah Mines Coalition—Stringers of ore, carrying copper, silver and gold, have been cut by the main tunnel, which is being driven from the Big Cottonwood side toward Alta. The ore occurs in parallel fissures to the Black Bess vein, which is the objective point.

Columbus Consolidated—The annual report shows that during five months, the company has produced 482 tons of concentrates of a net value of $10,469, and 1530 tons of crude ore, which sold for $30,008. There are 400 tons of concentrates and 200 tons of crude ore now at the mine for shipment. The company has $20,773 cash, and a note for $50,000. No detailed information was given of the new strike on the 400-ft. level.

Carbonate—This property is two miles from the Maxfield mine, in Big Cottonwood. It was operated between 1872 and 1878. The property has recently passed under new control, and active development work has been started. The greatest depth previously attained was 200 ft. The present management is preparing to go deeper. About 4000 tons of lead-silver ore, carrying an excess of iron, is now available. Shipments will be started as soon as the tramway is put in order.

Rainbow—Work has been resumed on this property in the Alta district. The company has a tunnel 370 ft. in length, which is being driven for a vein carrying lead and silver on the outcrop.

Summit County

Park City ore shipments for the week ended June 10 are: Silver King Coalition, 678,200 pounds; Daly West, 1,300,000; Daly-Judge, 1,132,000; Daly-Judge (zinc), 850,440; Little Bell, 126,000; total, 4,086,640 pounds.

Daly West—In addition to the regular output of lead-silver concentrates, the zinc product for May was 1165 tons. This is an increase of 500 tons over the April production.

Washington

Ferry County

Trade Dollar—A lease has been taken by Alfred M. Uhang, of Republic.

Knob Hill—This mine, idle for three years, has been acquired by a new company and will be reöpened.

First Thought Extension—Work has been resumed and shipping will be started.

Republic Mines Corporation—This company, operating the Lone Pine-Pearl-Surprise group in the Republic camp, reports an output of more than 4000 tons since Jan., 1910, the net value of which is $101,482, exclusive of ore at the smeltery and *en route*. The average yield of the ore shipped was $39.19 a ton.

Wisconsin

In the Baraboo iron region, ore is reported at Pewit's Nest, at 500 ft. Diamond drills are working.

Wyoming

A "gusher" was brought in near Spring Valley by the Reserve Oil Company on June 8. Renewed activity in the field has resulted.

Canada

BRITISH COLUMBIA

Steamer news received at Vancouver, June 14, confirms the excitement over the gold finds at Stewart in the Portland Canal district. A great reef extending to Stewart and running high in gold is reported by the Portland Canal local paper.

Rambler-Cariboo—Shoots of silver-lead ore of good grade have been found on both 800- and 900-ft. levels. The 1000-ft. level is being extended to cut these shoots at depth. The mine is looking better.

Standard—The fact of No. 5 tunnel is in 12 ft. of ore, of which 8 to 10 ft. is clean galena. The intermediate drift, above No. 5, has 14 ft. of ore, of which 8 ft. is stripping and the rest concentrating ore. These are the best showings of good ore at present occurring in the Slocan.

ONTARIO

Shipments from Cobalt for the week ended June 11 were: Chambers-Ferland, 65,460 lb.; Colonial, 41,640; Crown Reserve, 214,010; Hargraves, 60,000; Hudson Bay, 62,740; Kerr Lake, 120,140; La Rose, 142,550; Peterson Lake, 60,260; Temiskaming, 120,000; total, 886,800 pounds.

British American—This Cobalt company has resumed. The main shaft down 70 ft. is being put down to 200 ft. A compressor has been installed.

Beaver—The report for the quarter ended May 31 shows a balance of $28,290, less $5947 for pay roll and current accounts for May. The car of high-grade ore shipped May 4 assayed 3000 oz. silver to the ton and will net the company about $45,000. Preparations are being made to ship another car of high-grade, which is being stoped at the 200-ft. level.

Coniagas—The extension of the mill, which has been completed for some time is in operation, a sufficient supply of power now being obtainable. Sixty stamps in all are working, making the capacity of the mill 180 tons per day.

Moosehorn—The shaft is down 150 ft. and a large amount of drifting has been done at the 125-ft level, where some good veins have been encountered in this Elk Lake property.

La Rose Consolidated—The properties during the fiscal year ended May 31, produced 3,125,000 oz. of silver compared with 3,010,831 oz. for the previous year. May was the best the company has had at its Lawson property. During that period 25.4 tons of ore were produced assaying 2370 oz. per ton and having a net value of $27,877. The stope on the vein from which this material was taken was 80 ft. in length June 11. At the Princess property during May ore of a net value of $10,457 was mined, not including low grade and screenings.

Foley—Repair work is in progress preparatory to the resumption of operations at this mine at Mine Center in western Ontario.

Laurentian Mica Company—The plant at Ottawa was gutted by fire May 16 throwing 175 girls temporarily out of employment.

Island Smelting and Refining Company—This company has been formed at Toronto for the purpose of controlling the patents of a new smelting process invented by Dr. James S. Island, capital $3,000,000. Directors: J. W. Ford, president; Horace J. Davison, vice-president; W. F. Brodie, treasurer; Dr. James S. Island, John A. Rowland, Richard C. Warren and Richard E. Southey.

Mexico

BAJA CALIFORNIA

Boleo—The May product was 1132 metric tons and the yield per ton of ore 3.485 per cent. copper.

CHIHUAHUA

El Rayo—Mine report for quarter ended April 30: Mill ran, 83.6 days; ore crushed, 13,700 tons; value per ton, $13.96 U. S. Cy.; extraction, 82.6 per cent.; total revenue, $158,159; operating expense, $80,151; operating profit, $78,018; capital expenditure, $11,320; net profit, $66,698.

COAHUILA

Panuco—This copper property, controlled by the Continental company, of San Antonio, Texas, will resume. A. J. Tuttle is in charge.

JALISCO

Pinginto—The experimental mill on the Ameca river is treating a small tonnage. H. H. Cross and H. W. Young are in charge.

MEXICO

El Oro—Return for May: Mill No. 2 ran 30 days; crushed 30,457 tons; yielding bullion, $209,670; working expenses, $96,750; expenditure on development, $17,600; profit, $95,320; profit on railway, $4000; total profit, $99,320.

Mexico Mines—Return for May: Mill ran 31 days; crushed 11,866 tons; yielding bullion, $131,110; working expenses, $45,620; expenditure on development, $12,200; profit, $73,290.

SONORA

The mining town of Movarabi, including a 10-stamp mill, was destroyed by the forest fire on June 16 from the Ojo and Bacoachi mountains. The miners had a narrow escape and had to build back fires to enable them to flee to Cananea.

Bonanza de Cobre—After two years inactivity, development has been resumed on this property, north of Cananea. L. W. Powell and associates own it.

Greene-Cananea—The production of the Kirk mine has been doubled during the last two months, making it a close second to the Veta Grande. All its ores are first grade. Two 2000-k.v.a. turbine generators, and a duplicate of the present condenser, have been ordered for the main power plant. The expenditure will be $150,000.

Pacific Mining and Smelting Company—Following the election of Melbert B. Cary to succeed Theodore Douglas as president the announcement is made that the funds have been provided for the development and operation of the properties with Courtney De Kalb, of San Francisco as manager.

Artemisa—E. J. Wilcox, of Colorado, has completed the purchase of this zinc-lead deposit. The vein is described as 40 ft. in width, with 24 ft. of solid ore exposed in one place for 500 ft. and vertically 200 ft. The vein has porphyry for its walls, a linear distance of 1700 ft. and is 600 ft. above the flat. The San Felipe extension of this vein is being worked under bond by the Calumet & Arizona company. The Artemisa is reached from Poso, via Opodepe to San Felipe, and is 60 miles from the railway. The ore will average $30 per ton in value. One of the orebodies is 18 ft. in width and without any gangue. A railway will probably be built. Mr. Wilcox has been developing for two years. The assays showed an average of about 26 per cent. zinc, 22 per cent. lead and about 4 oz. silver.

Asia

INDIA-MYSORE

Kolar Goldfield—Gold reported in May was 46,815 oz., being 27 oz. less than in April and 301 oz. more than in May, 1909. For the five months ended May 31 the total was 227,650 oz. bullion in 1909, and 232,704 oz. in 1910; an increase of 5054 oz. The bullion reported this year was equal to $4,329,900, or 209,434 oz. fine gold.

Central America

Abangarez Goldfields—This Costa Rican company has been listed on the Boston Stock Exchange. It owns 118 sq.m. on the Pacific slope near Abangarez. The mill is equipped with forty 850-lb. stamps, to which are being added two 5-stamp batteries. It has a second mill, the Boston, with ten 850-lb. and ten 950-lb. stamps. The capital is 160,000 shares common and 40,000 shares preferred, of which 151,928 shares of common and 40,000 preferred are issued all of a par value of $25. Minor C. Keith is president.

THE MARKETS

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal Trade Review

New York, June 22—The coal trade in the East shows no important changes. Notwithstanding some drawbacks, the returns from different railroads given below indicate that there has been a substantial increase this year in coal carried to the seaboard Both bituminous and anthracite carriers show large gains this year. Only the coastwise shipments show a comparatively small gain.

In the West there have been no changes in the situation during the week. The stubborn strike in northern Illinois continues, with apparently no disposition on either side to give way. This is working to the present advantage of the southern Illinois and Indiana mines, which are doing a large trade. In the Southwestern districts also, no approach to a settlement is reported.

Coal Traffic Notes

Coal and coke tonnage originating on all lines of the Pennsylvania Railroad Company east of Pittsburg and Erie, five months ended May 31, short tons:

	1909.	1910.	Changes.
Anthracite	5,034,022	4,914,026	D. 119,996
Bituminous	14,975,985	16,930,680	I. 1,954,695
Coke	4,172,153	6,205,506	I. 2,033,353
Total	24,182,160	28,050,212	I. 3,868,052

The total increase this year was 16 per cent.

Coastwise shipments of coal from chief Atlantic ports, four months ended April 30, long tons:

	Anthracite.	Bitum.	Total.	PerCt
New York	5,510,582	3,626,494	9,137,076	62 7
Philadelphia	674,751	1,476,611	2,151,362	14 8
Baltimore	87,608	1,168,988	1,256,596	8.6
Newp't News	.....	1,055,869	1,055,869	7.2
Norfolk	.....	976,712	976,712	6.7
Total	6,272,941	8,304,674	14,577,615	100.0
Total, 1909.	6,666,249	7,366,347	14,032,596	.....

Total increase this year 545,019 tons, or 3.9 per cent. New York includes all the harbor shipping points.

Bituminous coal and coke tonnage of leading railroads in Pennsylvania and West Virginia four months ended April 30, short tons:

	Bituminous.	Coke.	Total.
Pennsylvania	13,720,319	5,143,636	18,863,955
Balt. & Ohio	8,717,471	1,551,760	10,269,231
Buff., Roch. & Pitts.	2,237,914	204,002	2,441,916
Buff. & Susqueh'na	359,635	78,348	437,983
Penn. lines, N. Y. C.	2,788,681	13,546	2,802,227
Pitts. & L. Erie	2,777,475	2,468,844	5,246,319
Pitts., Shawmut&N.	350,209	8,872	359,081
Norfolk & Western.	5,480,497	1,095,631	6,576,128
Ches. & Ohio	5,311,456	168,036	5,479,492
Total	41,743,657	10,732,675	52,476,332
Total, 1908	33,562,238	7,248,285	40,810,523

Total increase this year 11,665,809 tons, or 24.7 per cent. Anthracite tonnages of Pennsylvania and Baltimore & Ohio reported elsewhere.

Coal tonnage of railroads in Ohio Coal Traffic Association, four months ended April 30, short tons:

	1909.	1910.	Changes.
Hocking Valley	883,090	1,273,473	I. 390,383
Toledo & Ohio Cent.	326,008	492,545	I. 166,537
Baltimore & Ohio	345,887	749,542	I. 403,655
Wheeling & L. Erie	875,044	1,151,624	I. 276,580
Cleve., Lorain & Wh.	616,338	994,195	I. 377,857
Zanesville & Western	348,283	389,396	I. 41,113
Toledo Div., Pen. Co.	582,575	756,729	I. 174,154
L. Erie, Alliance & Wh.	331,304	391,723	I. 60,419
Marietta, Col. & Clev.	21,430	42,509	I. 21,079
Wabash-Pitts. Term.	.....	14,574	I. 14,574
Total	4,329,959	6,256,310	I. 1,926,351

Total increase this year, 44.5 per cent. Only the Ohio lines of the Baltimore & Ohio are included; the main-line tonnage is given elsewhere.

Anthracite tonnage of Baltimore & Ohio Railroad, four months ended April 30, was 322,459 tons in 1909, and 333,715 in 1910; increase, 11,256 tons.

New York

Anthracite

June 22—Sales are good for the season, but the greater part of the business doing is on contract deliveries. The taking of steam sizes is about on the usual level.

Schedule prices for domestic sizes are $4.45 for broken and $4.70 for egg, stove and chestnut, all f.o.b. New York harbor points. For steam sizes, current quotations are: Pea, $3@3.25; buckwheat, $2.20@2.50; No. 2 buckwheat or rice, $1.65@2; barley, $1.35@1.50; all according to quality, f.o.b. New York harbor. The lower prices are usually for washery coals.

Bituminous

Dullness is still the cry in the market, especially among the producers and sellers of the better grades of coal. The call is almost entirely for cheap coals. On this basis Eastern territory is taking a good deal of coal, but is not yet worked up to the point of closing for its winter supplies.

New York harbor is buying a little more, but is taking mostly gas coal and low grades of steam. Prices are unchanged. Good Miller vein steam coal can be had at $2.50, f.o.b. harbor points, but buyers want coal down to $2.30 or less.

Car supply is good, and transportation pretty regular. Coal comes through in good time and can be had when wanted. There is a little trouble yet at some mines, but not important.

In the coastwise trade vessels continue rather scarce and freight firm. From New York, rates are 75@80c. to points around Cape Cod. Large vessels from Philadelphia get 75c. to Boston, Salem and Portland; 65c. to Providence and the Sound.

Birmingham

June 20—Labor is still needed at some of the coal mines in this State. The output is good and the demand steady. An improvement is noted in the coke demand and production is being increased. Announcement is made that two coal mines opened up during this year are beginning to get out coal regularly. Mine No. 13, the new mine of the Tennessee company in the western part of the Birmingham district, is being pushed. This will be a shaft mine and the production is expected to reach 1500 tons per day.

There is a large tonnage being shipped to Louisiana. Coal prices have improved a little lately owing to the advance in miners' wages.

Chicago

June 20—Large buying of Indiana screenings and run-of-mine, with slackened business in eastern coals, due to the midsummer heat, are the features of the coal market. The chief steam coal supply, so long as the Illinois mines are nonproducing, will be from Indiana; Eastern coals will not be bought largely by consumers who have been accustomed to burn Illinois coal and find Indiana coal obtainable at less than the cost of smokeless, Hocking or Youghiogheny. In this fact lies the explanation of the disappointment of not a few would-be sellers of coal from east of Indiana. The Indiana mines are sending to this market a surprising amount of coal. At the same time, the smokeless and Hocking dealers are having good sales and probably will make a good number of new customers through the realization of the value of their coals.

Indiana coal fluctuates considerably, but in general sells for $2@2.10 for lump; $1.90@2.05 for run-of-mine, and $2@2.10 for screenings. The great summer demand for screenings makes that size slightly higher than run-of-mine and practically on a level with lump. In the opinion of men well versed in the coal trade the large demand for screenings has come to stay; it will be a permanent feature of the Chicago market.

Eastern coals sell for full list prices almost universally, Hocking bringing $3.15, Smokeless $3.55 for lump and $3.15 for run-of-mine and Youghiogheny

$3.22 for 1¼-in. lump. Anthracite and bituminous domestic coals are very dull.

Cleveland

June 20—A sudden arrival of warm weather has wiped out the domestic trade for the present. Steam trade is about as usual. Lake trade is slow, as orders are not pressing and a good deal of coal from Ohio is going to Illinois points, instead of the Lake ports. A better price is realized for it.

Prices are unchanged for all grades.

Indianapolis

June 20—The demand for coal at Ohio river points has been considerably relieved by the arrival of a big coal fleet down the Ohio from Pittsburg. A towboat and 26 barges were sunk before the fleet arrived at Jeffersonville. Mining operations in Indiana continue in full capacity and only slight variations are reported in the continued booking of orders.

The coal railroads continue to supply the Indiana Railroad Commission with briefs maintaining that the rates on coal are too low now and that the reduction to go into effect July 25 will work a hardship.

Pittsburg

June 21—Local demand for coal is somewhat reduced on account of a number of manufacturing establishments, particularly the iron-rolling mills, preparing to close July 1 for longer or shorter periods. Lake shipments continue heavy. Prices are fairly well maintained and we repeat former quotations as follows: Mine-run and nut, $1.20@1.25; ¾-in., $1.30@1.35; domestic 1½-in., $1.50; slack, 80@85c. per ton at mines.

Connellsville Coke—The market has been very quiet as to prompt and contract furnace coke, and even foundry coke, which is usually fairly active on contract at this season, has been rather quiet. Occasional sales of prompt furnace coke have been made at $1.65. On contract operators are quoting prices about 10c. higher, with no particular argument vouchsafed for the advance. We quote standard grades of Connellsville coke as follows, per net ton at ovens: Prompt furnace, $1.65@1.70; contract furnace, $1.80@1.90; prompt foundry, $2.15@2.25; contract foundry $2.25@2.50 per ton.

The *Courier* reports the production in the Connellsville and lower Connellsville region in the week ending June 11 at 401,737 tons, an increase of 3000 tons, and shipments at 4052 cars to Pittsburg, 6454 cars to points west and 951 cars to points east, a total of 11,457 cars.

St. Louis

June 20—While the market is a trifle weaker, yet coal is absorbed and prices remain about the same; they seem to have steadied down to a point where they will probably stay until the rest of Illinois goes to work. Operators in the fifth and ninth districts at the present prices are making about 35c. per ton clear on their coal, and are getting a full six days' run six days out of each week. This is an ideal condition which rarely exists. To be able to have a good car supply and good prices at the same time is a new and pleasing experience. The weather for the first time this year is real summer, and consequently the dealer trade has fallen off, though the dealers have had an unusually good season so far and the summer business has held up well. Prices, both retail and wholesale are satisfactory, and dealers are getting a fair margin. There seems to be, however, a marked tendency on the part of the dealers and large contract hauling concerns to stiffen up on the wagon-load contract price.

Reports from the Springfield and Carterville districts show that no progress is being made toward a settlement.

Current prices are as follows for the St. Louis market:

	Mine.	St. Louis.
Illinois, Standard:		
6-in. lump and egg	$1.60	$2.12
2-in. lump and nut	1.50	2.02
Mine-run	1.25	1.77
Screenings	1.30	1.82
Trenton:		
6-in. lump and egg	1.75	2.27
3-in. nut	1.50	2.02
Staunton or Mt. Olive:		
6-in. lump	1.70	2.22
2-in. nut	1.50	2.02
Mine-run	1.40	1.92
Screenings	1.30	1.82
Pocahontas and New River:		
Lump or egg	1.50	4.00
Mine-run	1.10	3.65
Pennsylvania Anthracite:		
Nut, stove or egg	.....	6.65
Grate	.....	6.40
Arkansas Anthracite:		
Egg or grate	3.35	5.35
Coke:		
Connellsville foundry	.....	5.40
Gas house	.....	4.50
Smithing	.....	4.15

The anthracite market is good, though the demand for grate seems to be easing off and the demand for chestnut increasing. This is to be noted, as grate is used by the large buyers who buy early, and chestnut by the country trade, which buys later. The tonnage will be a little lighter in June than in May, though there is no surplus on the market and prices are satisfactory.

FOREIGN·COAL·TRADE

Austro-Hungarian Trade—Imports and exports of fuel in Austria-Hungary, year 1909, metric tons:

	Imports.	Exports.	Excess.
Coal	10,479,244	632,658	Imp. 9,846,586
Brown coal	38,679	8,235,523	Exp. 8,196,844
Coke	701,281	197,313	Imp. 503,968
Briquets	48,640	38,803	Imp. 9,837
Total	11,267,844	9,104,297	Imp. 2,163,547

The exports of brown coal or lignite are almost all to Germany.

British Coal Trade—Fuel exports from Great Britain five months ended May 31, with coal sent abroad for steamships in foreign trade, long tons:

	1909.	1910.	Changes.
Coal	24,980,500	23,898,792	D. 1,081,708
Coke	432,575	351,427	D. 81,148
Briquets	624,301	635,417	I. 11,116
Total exports	26,037,376	24,885,636	D. 1,151,740
Steamer coal	7,804,452	7,633,034	D. 171,418
Total	33,841,828	32,518,670	D. 1,323,158

Imports were insignificant; only 2326 tons in 1909, and 13,792 tons this year.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of Welsh coal as follows, on June 4: Best Welsh steam, $3.99; seconds, $3.78; thirds, $3.66; dry coals, $3.72; best Monmouthshire, $3.60; seconds, $3.48; best steam smalls, $2.04; seconds, $1.76. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, June 22—The iron and steel markets are in rather an unsettled condition. The waiting position is not much in evidence, and a very considerable business is being transacted, especially when the season of the year is considered. There is, however, a persistent demand for low prices which is the occasion for much discussion between buyers and sellers, and makes the closing of new contracts slow work.

This is apparent in the pig-iron market. Sales of iron have been large, but users do not generally go beyond their third-quarter requirements unless they can get more concessions than makers are willing to grant. However, furnaces are reluctant to pile up stocks and will not go out of blast, so that many are gradually giving way. The curtailment of production which was talked about so much a month ago, has not gone very far. Stocks are an unknown quantity, but are generally believed to be larger than is comfortable at many furnaces. The situation is complicated by some Southern furnaces, which are frankly out for any price they can get.

In finished material there have been quite a number of transactions in structural steel for buildings and bridges, on which low prices have been made. Some good orders for cars have also been placed. Trade in bars and small material seems to be falling off a little, and sheets are also rather dull. Tinplates, however, are in active demand.

The lowest bid for the lock gates for the Panama Canal was submitted by the McClintic-Marshall Construction Company, the total amount being $5,374,378. The work will require about 40,000 tons of plates and 20,000 tons of other strutural material.

Lake Superior Iron Ore—Shipments of iron ore from the Lake Superior region

for the season to June 1 are reported by the Cleveland *Iron Trade Review* as follows:

Port.	1909.	1910.	Changes.
Escanaba.....	384,856	972,117	I. 587,261
Marquette.....	133,097	616,885	I. 483,788
Ashland.....	240,855	807,307	I. 566,452
Superior.....	608,515	1,310,958	I. 702,443
Duluth.....	1,215,925	2,530,185	I. 1,314,260
Two Harbors.....	725,820	1,364,213	I. 638,393
Total.....	3,309,068	7,601,665	I. 4,292,597

The large increase was due chiefly to the earlier opening of navigation this year. Deliveries at Lake Michigan ports up to June 1 this year were 1,230,827 tons.

Rates on Texas Iron Ore—The Texas Railroad Commission has now approved an iron-ore carrying rate of $1.34 per ton, carload lots, with a minimum weight of 50,000 pounds, from Jefferson to Texas City and Galveston. Recently the commission had allowed a rate of $1.50 for the same movement, the new rate being a reduction. The iron-ore deposits are those recently secured by Charles M. Schwab and associates.

Baltimore

June 21—Imports for the week included 200 tons ferromanganese and 1050 tons emery ore from Rotterdam; 1568 tons manganese ore from Liverpool; 6800 tons manganese ore from Poti, Russia; 10,600 tons iron ore from Cuba. Exports included 1685 tons steel rails and 115 tons rail fastenings to Tampico, Mexico.

Birmingham

June 20—Buying is in small lots, with an occasional order of a little better proportions. The aggregate of the sales for the present month will show up well. The price of iron on sales for the last quarter is hardening at $12 per ton. Reports are still current that some concessions have been made for immediate delivery iron and $11.50 per ton has been talked of but in the various offices there is no statement made of sales under $12 per ton. There is no iron going to the yards at present but at the same time it must be stated that the stocks of accumulated iron are not being reduced. Basic and charcoal irons are still in fair demand.

At Alabama City the Southern Iron and Steel Company has cut down the make of billets a little until the accumulated stocks have been reduced.

There is no change in conditions among the consuming interests in home territory. The melt is as heavy as it has been at any time this year.

Chicago

June 20—Quiet exists in the iron market. Sales of pig iron are in the aggregate large but are split up, as heretofore, into small lots. Delivery in the last half, with interest mainly in the third-quarter as yet, characterizes the market. The buying movement seems to have lost some of its impetus and summer dullness to have fallen on the trade. Prices continue $11.50@12 Birmingham on Southern No. 2 ($15.85@16.35 Chicago) and $16.50@$17 on Northern No. 2, with Lake Superior charcoal steady at $18.50@19. Small lots but frequent buying again has become the policy of the foundry melters. A few contracts are being made for 1911 delivery, but the great number of melters content themselves yet with inquiries on such business and make their purchases on earlier deliveries. Furnace agents profess faith in the stability of prices, and refuse to make quotations for fourth-quarter and 1911 delivery as low, by 25 or 50c. as for third-quarter delivery. This attitude of itself explains the reversion to buying for early delivery.

Sales of iron and steel products show no significant change, being of fair volume and well distributed. Coke continues at $5 for the best Connellsville, with sales good and the supply abundant.

Cleveland

June 20—The ore trade is slowing down a little; some vessels are not as busy as they might be. Ore is piling up on the docks, shipments to furnaces being rather slow.

Pig Iron—There is some inquiry, some small sales and general shading of prices. For Cleveland delivery bessemer has been cut to $16.65; while No. 2 foundry can be had at $15.25@15.50 per ton

Finished Material—Bar orders have dropped off and are now slow. Some structural sales are reported, and on these prices for material have been cut to 1.45 @1.50c. for early delivery.

Philadelphia

June 22—Makers of pig iron in eastern Pennsylvania have in several instances refused to take orders at less prices than they are naming. They pay but little attention to what they regard as an unwise course of makers in other markets in emptying their yards at any price they can get. Before the close of the week it is probable that pipe works in this vicinity will have closed contracts for large supplies of pipe iron to see them through with summer work. The inquiries for foundry iron from local and New England sources are gradually turning into business, but the orders are mainly for early delivery. No. 2 foundry is held at $17 for Northern and sales have been made at $16 for Southern with 50c. less for certain soft grades. Gray forge and basic are quoted at $16, without much business.

Steel Billets—Some users of billets have been quietly making purchases without letting the fact be known. There are makers of billets who see an advancing tendency within 30 days. Consumptive requirements are only meagerly supplied, especially for forging billets.

Bars—A restricted demand is felt throughout this territory and quotations show weakness, especially for common iron. Store demand is very low and no improvement is probable until August.

Sheets—Demand is irregular. Large consumers are asking for quotations to cover future deliveries, but for some time past large contracts have been exceptional.

Pipes and Tubes—It is said that concessions have been made on tubes within a week, but buyers decline to give any information. Discounts are nominally unchanged. Merchant pipe is moving in small lots.

Plates—A further shading in plates has been made on small orders from the outside figures which have prevailed all through the season. It is also rumored that a further shading has been made in reply to inquiries from car builders and the rumor is accepted as correct.

Structural Material—Large orders have been secured for bridge material which will bring work to the American Bridge Company's plant here. The other makers of structural material in this territory have picked up a few scattering orders.

Scrap—Scrap continues dull and some offerings show that holders are disposed to turn some stock into cash, chiefly heavy cast scrap and No. 1 wrought railroad.

Pittsburg

June 21—Business in finished-steel products has not been quieting down any faster than was expected, if as fast. Specifications continue fairly good on contracts, while new business is light. On all hands a dull summer has been regarded as a certainty, and on the whole it is probably the fact that conditions today are better than was expected a month ago would be the case. Since the beginning of April all buyers have curtailed their purchases as much as possible, yet the mills have had a great deal to do, for they have been running at only about 10 per cent. below their maximum rate, reached early in the year. This, in the circumstances, ought to be regarded as very encouraging.

The plans for closing mills being developed indicate as a rule shut-downs for only a fortnight in July. Some mills will run right through. The heaviest curtailment will be among the iron mills, practically all of which will close July 1, certainly for a month, if not for two.

The largest contract placed for finished steel for a long time is that for steel gates for the Panama canal locks. This was awarded at Washington yesterday to the McClintic-Marshall Construction Company, Pittsburg, which is backed, as to the plain material, plates, shapes, etc., by the Jones & Laughlin Steel Company, about 55,000 tons of steel being involved. Presumably the contract price is very low

relative to the amount of work, the successful bid being $730,000 below the next higher bid, and barely over half the highest bid. The four bids submitted were: McClintic-Marshall Construction Company, $5,374,475; United States Steel Products Export Company (Steel Corporation) $6,103,041; Maryland Steel Company, $8,409,369; Riter-Conley Manufacturing Company, $10,183,257.

Pig Iron—The Standard Sanitary Manufacturing Company has bought between 12,000 and 14,000 tons of iron for third-quarter delivery to its Allegheny and New Brighton plants, paying substantially $14.35 for No. 2 foundry, $14 for No. 3 and $13.60 for gray forge, at Valley furnaces. A portion of the iron, less than half, comes from western Pennsylvania furnaces outside the valleys. This covers the company fairly well for third quarter. As already reported, the Westinghouse Air Brake Company has bought, its purchases of about 18,000 tons of forge and foundry covering it practically through the year. It paid $14.35@14.50, Valley, for nearly all its iron. Thus the two largest local consumers of foundry iron have covered themselves in the past fortnight, and with such large buyers taking hold opinions are again expressed that the bottom has been reached on this long decline, which has covered seven months in point of time and $2.75 to $3.25 in point of value for the different grades. On the other hand, there remains much unsold tonnage, with the absorptive capacity of the market correspondingly reduced. All signs fail in such a market, which struggles on the one hand with prices being actually below cost of production to furnaces using purchased coke and ore; and on the other with large stocks in merchant furnace yards and the prospect that ore prices for next season will be lower. While $14.75, Valley, is regarded as the basic market, a local steel interest has picked up two small lots at a lower figure, believed to be $14.50. We quote the open market as follows, concessions being perhaps obtainable: Bessemer, $15.75; basic, $14.75; malleable, $15; No. 2 foundry, $14.50; forge, $13.75, all at Valley furnaces, 90 cents higher delivered Pittsburg.

Ferromanganese—The market is quiet and rather weak, prompt lots being quotable at about $39.50 and forward deliveries at $40@40.50, Baltimore, freight to Pittsburg being $1.95 per ton.

Steel—The market is a trifle easier in tone, demand being light, but prices are not quotably lower, standing at about $25@25.50 for bessemer billets, $26@26.50 for bessemer sheet bars, $28@28.50 for open-hearth billets and $29@29.50 for open-hearth sheet bars, all f.o.b. maker's mill, Pittsburg or Youngstown.

Sheets—The independent sheet and tinplate manufacturers who operate under union auspices held a meeting at Pittsburg, last Wednesday, and a conference Thursday and Friday with the Amalgamated Association on the wage scale to govern the hot-mill operations in the year beginning July 1, adjourning to meet again tomorrow. The holding of a two days' session and the adjournment to a definite date less than a week later are, according to experience, indicative that conditions are favorable to an adjustment.

Demand for sheets is lighter and price cutting is somewhat more widespread, although generally still confined to about $2 a ton. Regular prices are 2.40c. on black and 3.50c. on galvanized, with corrugated roofing at $1.70 per square for painted and $3 for galvanized. Blue annealed sheets, which commanded premiums of $2@3 a ton for months, for any early delivery, are down practically to the official price of 1.75c. for 10 gage.

St. Louis

June 20—Pig iron is still a very slow seller. A few inquiries are coming in, but only a small tonnage is moving. Price seems to be no inducement for buyers to take on additional stocks. The quotation of $12, Birmingham, or $15.75, St. Louis, remains the current figure. Local producers are doing much better than the Southern and are about to run full. They are also obtaining a slight premium over Southern iron.

FOREIGN IRON TRADE

Russian Iron and Steel—A preliminary report on the iron and steel production of Russia gives the following figures for two years past, in metric tons:

	1908.	1909.	Changes.
Pig iron	2,751,000	2,817,000	I. 66,000
Blooms, billets, ingots, etc.	2,809,000	3,970,000	I. 261,000
Finished iron and steel	2,335,000	2,572,000	I. 237,00

The blooms, billets, etc., and the finished material include both wrought iron and steel. The increases last year came chiefly from the South Russian district.

METAL MARKETS

New York, June 22—The metal markets generally continue quiet, without much evidence of strength.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
May 1910..	$ 717,678	$ 3,143,338	Imp.$ 2,425,660
" 1909..	11,171,265	2,263,721	Exp. 8,907,544
Year 1910..	47,917,384	14,812,614	" 33,104,770
" 1909..	55,487,891	17,767,857	" 37,720,034
Silver:			
May 1910..	4,170,754	3,354,715	Exp. 816,039
" 1909..	4,428,848	3,857,388	" 571,060
Year 1910..	22,506,835	18,593,349	" 3,913,486
" 1909..	23,854,629	18,532,753	" 5,321,876

Exports from the port of New York, week ended June 18: Gold, $50,400, chiefly to Panama; silver, $484,986, chiefly to London. Imports: Gold, $75,240; silver, $10,867, both from the West Indies and South America.

Exports of silver from London to the East from Jan. 1 to June 9, reported by Messrs. Pixley & Abell:

	1909.	1910.	Changes.
India	£2,311,900	£2,748,500	I. £ 436,600
China	1,075,100	1,113,500	I. 38,400
Straits	82,800	.....	D. 82,800
Total	£3,469,800	£3,862,000	I. £ 392,200

Gold—The price of gold on the open market in London continued at 77s. 9d. per oz. for bars and 76s. 5d. per oz. for American coin. There was no special demand.

Platinum—The market is steady at the recent advance. Dealers are asking $31.50@32 per oz. for refined platinum and $37 per oz. for hard metal.

Our Russian correspondent writes from St. Petersburg, under date of June 9, that the market is firm. The prices remain generally unchanged. In St. Petersburg some sales have been made at 25,200 rubles per pood. At Ekaterinburg the prices show a little increase. From the Ural it is reported that the production of the year is about up to that of the previous year. The nominal quotations, subject to negotiation, are in St. Petersburg, 25,000 rubles per pood; at Ekaterinburg, 6.40 rubles per zolotnik—$24.50 and $24.06 per oz., respectively.

SILVER AND STERLING EXCHANGE

June.	16	17	18	20	21	22
New York....	53⅛	53⅛	53⅛	53¾	53¾	53¾
London	24 11/16	24 11/16	24 11/16	24¾	24¾	24¾
Sterling Ex..	4.8660	4.8685	4.8690	4.8690	4.8665	4.8665

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—The market has again shown very small fluctuations, and closes steady at 24¾d. in London.

Copper, Tin, Lead and Zinc

June.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
16	12⅝ @12⅞	12⅛ @12⅜	54⅛	32½	4.32½ @4.35	4.17½ @4.22½	4.92½ @4.97½
17	12⅝ @12⅞	12¼ @12⅜	55	32⅝	4.32½ @4.35	4.17½ @4.22½	4.92½ @4.97½
18	12⅝ @12⅞	12¼ @12⅜	...	32⅝	4.32½ @4.35	4.17½ @4.22½	4.92½ @4.97½
20	12⅝ @12⅞	12¼ @12⅜	55	32¾	4.32½ @4.35	4.17½ @4.22½	4.95 @4.97½
21	12⅝ @12⅞	12¼ @12⅜	55⅛	32⅝	4.32½ @4.35	4.17½ @4.22½	4.95 @4.97½
22	12⅝ @12⅞	12¼ @12⅜	54¾	32½	4.32½ @4.35	4.17½ @4.22½	4.95 @4.97½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Between June 15 and 22, a rather large business was done, especially in electrolytic, both for domestic consumption and for export. The sales are believed to aggregate in the neighborhood of 40,000,000 lb. Stocks in the hands of manufacturers both in this country and in Europe are very low, and at the level of prices recently established buyers felt encouraged to take hold. Most of the copper was bought for shipment during the next 30 days, but considerable quantities were also taken for August and September shipment. Orders in the market were the subject of keen competition which prevented much advance in price. During the latter part of the week most of the agencies have been willing to do business at 12½c., delivered, 30 days, corresponding to a little less than 12⅜, cash, New York. The leading seller continued to remain out of the market. Transactions in Lake copper were moderate, round lots going at about 12¾c. On June 21 Calumet & Hecla reduced its price for delivery in Europe to 13c., corresponding to about 12.75@12.80c., New York.

At the close Lake copper is quoted at 12⅝@12⅞c., and electrolytic copper in cakes, wirebars and ingots at 12¼@12½c. Casting copper is quoted nominally at 12⅛@12¼ cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 14¼c. base, carload lots at mill.

On Thursday, June 16, standard copper reached the low price of £54 2s. 6d. At this level, speculation in standard copper, which has been stagnant for some time, again arose, and on Friday the market advanced to £55. On Monday and Tuesday the market was firm thereat. On Wednesday, June 22, the market eased off somewhat to £54 15s. and closes at £54 15s. for spot, and £55 10s. for three months.

Refined and manufactured sorts we quote: English tough, £58; best selected, £58@£59 10s.; strong sheets, £67@£68 per ton.

Visible stocks of copper in London and France on June 15—including 5630 tons afloat from Chile and Australia—are reported at 236,051,200 lb., a decrease of 3,091,200 lb. from the June 1 report.

Exports of copper from New York for the week were 5069 long tons. Our special correspondent gives the exports from Baltimore at 1249 tons.

Tin—The market in London remained steady throughout the week. Transactions were small and fluctuations insignificant. The close is cabled at £147 17s. 6d. for spot, and £148 17s. 6d. for three months.

The domestic market closely followed that of London so far as the little business that was done for future delivery was concerned. Spot material is still scarce and commanding a premium. At the close it can be purchased at 32½ cents.

Tin output of the Federated Malay States for the five months ended May 31 was 18,404 long tons in 1909, and 17,339 in 1910; a decrease of 1065 tons.

Messrs. Robertson & Bense report receipts of tin ore and concentrates from Bolivia at Hamburg, Germany, in May at 622 tons.

Lead—The market is quiet and firm. Prices are unchanged at 4.17½@4.22½c. St. Louis, and 4.32½@4.35c. New York.

The London market for Spanish lead is higher at £12 15s., and for English lead at £12 17s. 6d. per ton.

The Sherwin-Williams Company is building a corroding plant at Pullman Station, Chicago, Ill. Deliveries from this plant are expected to be made by midsummer. The plant, employing the old Dutch process, comprises 16 stacks, each with a capacity of 10,000 pots.

Spelter—The market continues very quiet. Demand is small and is freely met, and at the close St. Louis is quoted at 4.95@4.97½c., and New York at 5.10@5.12½ cents.

New York quotations for spelter, June 16-18, inclusive, were 5.07½@5.12½c.; June 20-22, inclusive, 5.10@5.12½ cents.

The London market for good ordinaries is unchanged at £22, and for specials £22 5s. per ton.

Base price of zinc sheets is $7.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—The market remains more quiet than it has been for some time. Current quotations 23¼@23½c. per lb. for No. 1 ingots, New York delivery. The foreign market is steady.

Antimony—The market remains quiet. Cookson's is quoted at 8.15@8.20c. per lb. Other prices are 7⅞@8c. for U. S.; 7⅜@7½c. for outside brands.

Quicksilver—New York quotations are $47 per flask of 75 lb. for large orders; $48@49 for jobbing lots. San Francisco, $46@46.50 for domestic orders and $2 less for export. The London price is £8 15s. per flask, with £8 12s. 6d. quoted by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot, from 50c. for 500-lb. lots, up to 55c. for 200-lb. lots. The price for electrolytic is 5c. higher.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Cadmium—Current quotations are 65@70c. per lb. in 100-lb. lots at Cleveland, Ohio.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, five months ended May 31, figures in long tons, except quicksilver, which is in pounds:

Metals:	Imports.	Exports.	Excess.
Copper, long tons	55,300	31,363	Imp. 23,937
Copper, 1909....	54,128	27,894	Imp. 26,234
Tin, long tons....	16,551	16,169	Imp. 382
Tin, 1909.....	15,846	15,193	Imp. 653
Lead, long tons..	87,663	21,252	Imp. 66,411
Lead, 1909.....	91,615	19,430	Imp. 72,185
Spelter, l'g tons..	51,628	3,774	Imp. 47,854
Spelter, 1909....	45,279	2,713	Imp. 42,566
Quicksilver, lb...	2,641,390	452,436	Imp. 2,188,954
Quicksilver, '09	1,717,168	418,982	Imp. 1,298,186
Ores:			
Tin ore and con.	11,182	.....	Imp. 11,182
Tin ore, 1909...	9,686	.....	Imp. 9,686
Pyrites.....	333,059	.....	Imp. 333,059
Pyrites, 1909...	328,597	.....	Imp. 328,597

Copper totals include metallic contents of ore and matte. Exports include reexports of foreign material. Of the imports in 1910, the United States furnished in all 100 tons copper matte, 17,210 tons fine copper, and 11,577 tons lead. This lead was chiefly Mexican, refined in this country.

Zinc and Lead Ore Markets

Platteville, Wis., June 18—The highest price paid this week for zinc ore was $41.50; the base price, 60 per cent. zinc, was $40 per ton. The base price paid for 80 per cent. lead ore was $48@50 per ton.

SHIPMENTS, WEEK ENDED JUNE 18.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville.....	454,900	131,200	353,200
Galena.....	300,300	70,000	.....
Shullsburg.....	201,000	.....	.....
Cuba City.....	168,655	.....	224,000
Highland.....	125,400	80,000	.....
Montfort.....	.....	88,000	.....
Linden.....	.....	.....	179,710
Total.....	1,250,255	369,200	756,910
Year to date.....	38,862,296	3,182,939	9,134,005

In addition to the above there was shipped during the week to the separating plants, 3,743,225 lb. zinc concentrates.

Joplin, Mo., June 18—The highest price paid for zinc sulphide ore was $44, the base $39@40 per ton of 60 per cent. zinc. Zinc silicate sold as high as $27, on a base price of $20@22 per ton of 40 per cent. zinc. The average price, all grades of zinc ore, was $37.54. The high price for lead ore was $49 for ores of 80 per cent. lead or better, with deductions of $1 for each 1 per cent. under. Average price, all grades of lead, $48.82 per ton.

While there was a decline in the zinc market and the market was easy from a buyer's standpoint, yet there was a moderate firmness with heavy purchases and over an average shipment. A very large proportion of the ore that is for sale on the present price level is now sold. It was purchased so quietly that prices have been undisturbed, and with

all this ore sold there is no weakness in the market tonight.

SHIPMENTS, WEEK ENDED JUNE 18.

	Zinc, lb.	Lead lb.	Value.
Webb City-Carterville	4,583,070	658,030	$105,489
Joplin	1,569,450	196,900	36,164
Alba-Neck	901 870	.....	19,390
Duenweg	570,890	165,590	14,658
Miami	559,580	238,270	12,073
Oronogo	488,690	1,770	10,266
Galena	408,320	62,110	9,249
Quapaw	313,500	50,360	6,851
Jackson	357,910	7,440	6,620
Granby	380,130	14,090	5,715
Badger	249,930	13,670	5,326
Carthage	184,060	.....	3,773
Stott City	178,870	.....	3,577
Spurgeon	197,180	.....	1,969
Aurora	167,180	.....	1,838
Sarcoxie	53,090	.....	1,061
Totals	11,163,720	1,408,230	$244,029
25 weeks	274,095,740	40,007,030	$6,539,503

Zinc value, the week, $209,611; 25 weeks, $5,497,180
Lead value, the week, 34,418; 25 weeks, 1,042,323

MONTHLY AVERAGE PRICES

Month.	Zinc Ore.				Lead Ore.	
	Base Price.		All Ores.		All Ores.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$41.25	$47.31	$38.46	$45.16	$52.17	$56.99
February	36.94	40.69	34.37	39.47	50.50	53.64
March	37.40	43.60	34.71	39.71	50.82	51.26
April	38.63	41.00	37.01	39.33	55.63	49.72
May	40.06	40.19	37.42	37.51	56.59	48.16
June	44.15	.....	40.35	.....	57.52	.....
July	43.06	.....	41.11	.....	53.74	.....
August	48.25	.....	44.54	.....	57.60	.....
September	47.70	.....	44.87	.....	56.11	.....
October	49.50	.....	45.75	.....	55.02	.....
November	51.31	.....	48.29	.....	53.94	.....
December	49.45	.....	47.57	.....	55.26	.....
Year	$43.98	.....	$41.20	.....	$54.60	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Other Ore Markets

Iron Ore—Current quotations for Lake Superior ores, on dock at Lake Erie ports, are: Bessemer ore—base 55 per cent. iron and under 0.45 phosphorus—$5 per ton for old Range and $4.75 for Mesabi; nonbessemer—base 51.5 per cent. iron—$4.20 for old Range and $4 for Mesabi.

In the East there is no organization of sellers, and a wide range of prices exists, according to quality and location of mines. A good nonbessemer ore, around 50 or 55 per cent. iron, can be had at $3@3.50 per ton, f.o.b. mines; but this cannot be taken as a positive or general price.

Manganese Ore—The base price, as fixed by the large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent. or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess of phosphorus and silica.

Zinc Ore—For Rocky Mountain blende, delivered at Kansas smelting points, the current price is for the zinc content, less eight units, at the St. Louis price for spelter, less $14@15 per 2000 lb. of ore, according to quality, especially as to iron and lead content. See also Joplin and Wisconsin ore markets.

Pyrites—Domestic furnace sizes fetch 11@11½c. per unit, delivered at eastern acid works; fines, 10¾@11c. Pyrites containing arsenic realize from ½@1½c. per unit less.

Tungsten Ore—Ferberite, wolframite and huebnerite ores, $6.50@7 per unit per ton of 2000 lb. for ore containing 60 per cent. of tungsten trioxide. For scheelite ores, 50c.@$1.50 per unit less.

CHEMICALS

New York, June 22—The usual summer quiet is manifest in the general market, and business is not active.

Copper Sulphate—Business is fair and prices unchanged at $4 per 100 lb. for carload lots and $4.25 per 100 lb. for smaller parcels.

Arsenic—The market is still inactive. On small sales prices are unchanged at $2.30@2.40 per 100 lb. for white arsenic.

Nitrate of Soda—Business in this article has subsided into dullness. On spot sales quotations are a shade lower, at 2.07½c. per lb. Futures continue to be held at 2.10c. per lb., with little business forward.

Petroleum

Production and shipments of petroleum in the Southwest, reported by *Oil and Gas Journal*, in barrels of 42 gal. each:

	Production.	Deliveries.
Oklahoma	4,619 240	4,365,912
Southeast Texas	656,993	.....
Louisiana	515,538	.....

Oklahoma stocks on May 31 were 55,915,030 bbl. The new wells completed in May were: Oklahoma, 407 oil and 17 gas; southeast Texas, 51 oil and 2 gas; Louisiana, 2 oil wells.

The Standard Oil has reduced prices 5c. per bbl. for Pennsylvania crude oil.

MINING·STOCKS $

New York, June 22—The general stock markets have not been especially active during the week, and trading has been on a moderate scale. The tone of the markets has been better, on the whole, and prices have been inclined to advance, with only moderate checks. Some disturbing elements are out of the way and the Exchange seems to have made up its mind to accept the settlement and make the best of it.

The copper stocks on the Curb were inclined to do better, but the gains were only fractional for the most part, and trading was rather limited. Outside of the coppers, Goldfield Consolidated was strong and active, making a substantial advance. Some of the other Nevada stocks rose in sympathy. Cobalt stocks were inclined to be strong, on a moderate demand.

Boston, June 21—The copper-share market is at a standstill. The reason is perfectly obvious—hot weather and the weakness of the metal. Coppers have been sold to a standstill and under present conditions there is little incentive to buy them. There is this much to say, however. With reduced dividends by those fortunate enough to be able to pay any, the worst is rapidly coming to the sur-

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company.	March.	April.	May.
Arizona, Ltd.	2,886,000	2,340,000	2,610,000
Balaklala	1,263,733	1,109,311	1,148,762
Boleo (Mexico)	2,148,383	2,777,800	2,735,680
Copper Queen	10,809,488	9,920,000	.....
Calumet & Ariz.	2,820,000	2,400,000	1,778,000
Cananea (Mexico)	3,700,000	4,262,000	.....
Detroit	1,698,975	1,930,000	.....
Imperial	825,000	800,000	.....
Nevada Con. (Est.)	5,339,466	5,500,000	5,500,000
Old Dominion	2,674,000	2,325,000	2,174,000
Shannon	1,468,000	1,288,000	1,326,000
Superior & Pitts.	2,370,000	2,130,000	2,276,000
Utah Copper Co.	7,853,288	7,902,643	.....
Butte District	24,000,000	25,000,000	24,850,000
Lake Superior	19,250,000	16,250,000	19,250,000
Total production.	89,366,867	86,934,754	.....
Imports, bars, etc.	20,178,202	21,180,396	.....
Imp. in ore & matte	6,181,476	12,527,371	.....
Total	115,726,545	120,642,521	.....

Butte district and Lake Superior figures are estimated; others are reports received from companies. Imports duplicate production of Cananea, and that part of Copper Queen production which comes from Nacozari. Boleo copper does not come to American refiners. Utah Copper report from February includes the output of the Boston mill.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
VI, 1909	116,567,493	60,591,116	70,966,457
VII	118,277,603	75,520,083	75,018,974
VIII	120,597,234	59,614,207	48,382,704
IX	118,023,139	52,105,955	50,077,777
X	124,657,709	66,359,617	56,261,238
XI	121,618,369	66,857,873	55,266,595
XII	117,828,655	69,519,501	59,546,570
Year	1,405,403,056	705,051,591	680,942,620
I, 1910	116,547,287	78,158,387	81,691,672
II	112,712,493	66,618,322	37,369,518
III	120,067,467	62,844,818	40,585,767
IV	117,477,639	67,985,951	31 332,434
V	123,242,476	59,305,222	45,495,400

	Visible Stocks.		
	United States.	Europe.	Total.
VI, 1909	169,848,141	127,352,960	297,201,101
VII	154,858,061	150,928,960	305,787,021
VIII	122,596,607	171,492,160	294,088,767
IX	135,196,930	197,993,600	333,190,530
X	151,472,772	210,224,000	361,696,772
XI	153,509,626	222,566,400	376,076,026
XII	153,003,527	236,857,600	389,861,127
I, 1910	141,766,111	244,204,800	385,970,911
II	98,463,339	248,236,800	346,700,139
III	107,187,992	254,150,400	361,338,392
IV	123,824,874	249,625,600	373,450,474
V	141,984,159	246,870,400	388,854,559
VI	160,425,973	239,142,400	399,568,373

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

face and the period for improvement must fast be approaching.

Old Dominion directors have reduced the quarterly rate from 50 to 25c., which resulted in dropping the shares to a low at $29.50. Almost a $6 recovery followed this in less than a week. North Butte directors have also reduced their quarterly dividend rate again, this time to 30c. The stock fell to $25.50 on early reports that the dividend would be passed entirely, but a substantial recovery followed.

The new Lake issues have maintained their equilibrium. There has been in fact, some improvement in prices pretty much throughout the copper-share list.

Curb business has been lifeless, although Inspiration and Goldfield Consolidated have been strong. A 5c. assessment by the Majestic Mines brought a sharp break in the stock.

Assessments

Company.	Delinq.	Sale.	Amt.
Alameda, Ida.	June 10	July 2	$0.00½
Alta, Nev.	July 4	July 29	0.03
Amador, Ida.	Feb. 24	June 30	0.01
Belcher, Nev.	July 4	July 29	0.10
Butte-Alex-Scott.	July 1	.....	1.00
Caledonia, Nev.	June 17	July 8	0.10
Central Eureka, Nev.	June 12	July 16	0.02½
Chollar, Nev.	July 3	July 29	0.10
Crown Point, Nev.	June 26	July 20	0.10
Davis-Daly, Mont.	July	.....	0.50
Davis-Daly, Mont.	Sept.	.....	0.50
Hancock Con., Mich.	Au.Oct.	.....	3.00
Justice, Nev.	June 25	July 19	0.03
May Day, Utah.	July 15	.....	0.02
Ophir, Nev.	July 4	Aug. 2	0.25
Ojibway, Mich.	Oct.	.....	1.00
Reindeer, Ida.	May 31	Aug. 1	0.00½
Rhode Island Copper, Mich.	.....	.....	0.50
Scottish Chief, Utah.	.....	.....	0.01
Sierra Nevada, Nev.	June 21	July 12	0.10
Union, Nev.	June 9	July 1	0.10
Yellow Jacket, Nev.	June 9	July 11	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1909.	1910.	1909.	1910.
January	51.750	52.375	23.843	24.154
February	51.472	51.534	23.706	23.794
March	50.468	51.454	23.227	23.690
April	51.428	53.221	23.708	24.483
May	52.905	53.870	24.343	24.797
June	52.538	.....	24.166	.....
July	51.043	.....	23.519	.....
August	51.125	.....	23.588	.....
September	51.440	.....	23.743	.....
October	50 923	.....	23.502	.....
November	50.703	.....	23.351	.....
December	52.226	.....	24.030	.....
Total	51.502	.....	23.706	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER.

	New York.				London.	
	Electrolytic		Lake.			
	1909.	1910.	1909.	1910.	1909.	1910.
January	13.893	13.620	14.280	13.870	61.198	60.923
February	12.949	13.332	13.295	13.719	57.688	59.388
March	12.387	13.255	12.826	13.586	56.231	59.214
April	12.56½	12.733	12.93⅞	13.091	57.363	57.238
May	12.393	12.550	13.238	12.885	59.338	56.313
June	13.214	.....	13.548	.....	59.627	.....
July	12.880	.....	13.363	.....	58.556	.....
August	13.007	.....	13.296	.....	59.393	.....
September	12.870	.....	13.210	.....	59.021	.....
October	12.700	.....	13.030	.....	57.551	.....
November	13.125	.....	13.354	.....	58.917	.....
December	13.298	.....	13.647	.....	59.906	.....
Year	12.982	.....	13.335	.....	58.732	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1909.	1910.	Month.	1909.	1910.
January	28.060	32.700	July	29.125	.....
February	28.290	32.920	August	29.966	.....
March	28.727	32.403	September	30.293	.....
April	29.445	32.976	October	30.475	.....
May	29.225	33.125	November	30.859	.....
June	29.322	.....	December	32.913	.....
			Av. Year	29.725	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	4.175	4.700	4.025	4.582	13.113	13.650
February	4.018	4.613	3.868	4.445	13.313	13.328
March	3.986	4.459	3.835	4.307	13.438	13.063
April	4.168	4.376	4.051	4.225	13.297	12.641
May	4.287	4.315	4.214	4.164	13.225	12.550
June	4.350	.....	4.291	.....	13.031	.....
July	4.321	.....	4.188	.....	12.563	.....
August	4.363	.....	4.227	.....	12.475	.....
September	4.342	.....	4.215	.....	12.781	.....
October	4.341	.....	4.215	.....	13.175	.....
November	4.370	.....	4.252	.....	13.047	.....
December	4.560	.....	4.459	.....	13.125	.....
Year	4.273	.....	4.153	.....	13.049	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	5.141	6.101	4.991	5.951	21.425	23.350
February	4.889	5.569	4.739	5.419	21.562	23.188
March	4.757	5.637	4.607	5.487	21.438	23.031
April	4.965	5.439	4.815	5.289	21.531	22.469
May	5.124	5.191	4.974	5.041	21.975	22.100
June	5.402	.....	5.252	.....	22.000	.....
July	5.402	.....	5.252	.....	21.969	.....
August	5.729	.....	5.579	.....	22.125	.....
September	5.796	.....	5.646	.....	22.906	.....
October	6.199	.....	6.043	.....	23.200	.....
November	6.381	.....	6.231	.....	23.188	.....
December	6.249	.....	6.099	.....	23.094	.....
Year	5.503	.....	5.352	.....	22.201	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PRICES OF PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$17.18	$19.90	$16.40	$17.98	$16.26	$17.94
February	16.73	18.96	16.09	17.21	15.90	17.38
March	16.40	18.53	15.84	16.93	15.62	17.00
April	15.79	18.28	15.05	16.84	15.06	16.75
May	15.77	17.10	15.02	15.94	15.08	16.18
June	16.13	.....	15.84	.....	15.63	.....
July	16.40	.....	15.90	.....	15.96	.....
August	17.16	.....	16.17	.....	16.20	.....
September	18.44	.....	16.80	.....	17.03	.....
October	19.75	.....	17.84	.....	18.02	.....
November	19.90	.....	18.37	.....	18.09	.....
December	19.90	.....	18.15	.....	17.90	.....
Year	$17.46	.....	$16.46	.....	$16.40	.....

STOCK QUOTATIONS

COLO. SPRINGS June 21

Name of Comp.	Bid.
Listed:	
Acacia	.06½
Cripple Cr'k Con.	.03
C. K. & N.	.19
Doctor Jack Pot.	.06½
Elkton Con.	.80
El Paso	.85
Fannie Rawlins.	‡.05½
Findlay	.08½
Gold Dollar	‡.15
Gold Sovereign	.03¾
Isabella	.18½
Mary McKinney	‡.58
Pharmacist	.03½
Portland	‡1.25
Vindicator	.94
Work	.03¾
Unlisted:	
Golden Cycle	1.50
United Gold Mines	‡.08½

SALT LAKE June 21

Name of Comp.	Clg.
Carisa	.50
Colorado Mining	.39
Columbus Con.	.53
Daly Judge	3.50
Grand Central	1.15
Iron Blossom	.72
Little Bell	1.30
Little Chief	‡.45
Lower Mammoth	.31½
Mason Valley	7.00
Maj. Mines	.58
May Day	.01½
Nevada Hills	1.50
New York	.13
Prince Con	.60
Red Warrior	‡6.00
Silver King Coal'n	2.12½
Sioux Con.	.18
Uncle Sam	.23
Victoria	‡1.07½

SAN FRANCISCO. June 21.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Atlanta	.11
Belcher	.60
Best & Belcher	.25
Caledonia	.48
Challenge Con.	.17
Chollar	.10
Confidence	‡.75
Con. Cal. & Va.	.91
Crown Point	‡.62
Exchequer	.20
Gould & Curry	.16
Hale & Norcross	.30
Mexican	1.05
Ophir	.85
Overman	.59
Potosi	.37
Savage	.21
Sierra Nevada	.25
Union	.31
Yellow Jacket	.60

Name of Comp.	Clg.
MISC. NEVADA	
Belmont	3.55
Daisy	.05
Jim Butler	.29
MacNamara	.26
Midway	.25
North Star	.06
West End Con.	.56
Atlanta	.11
Booth	.05
C.O.D. Con.	.08
Columbia Mt.	.06
Comb. Frac.	.52
Great Bend	.03
Jumbo Extension	.23
Oro	.07
Red Hill	.03
Sandstorm	.01
Silver Pick	.06
St. Ives	.10
Tramps Con.	.04

N. Y. EXCH. June 21

Name of Comp.	Clg.
Amalgamated	64⅞
Am. Agri. Chem.	‡43
Am.Sm.&Ref.,com	77⅛
Am. Sm. & Ref., pf.	103⅜
Anaconda	‡40
Bethlehem Steel	‡27⅜
Col. & Hock. C. & I.	‡6⅛
Colo. Fuel & Iron	35½
Du Pont P'd'r, pf.	‡87½
Federal M. & S.	‡41
Great Nor., ore ctf.	61
Nat'nalLead,com.	74¾
National Lead, pf.	‡108
Nev. Consol.	19½
Pittsburg Coal	18¼
RepublicI&S,com.	34¾
Republic I & S, pf.	‡95½
SlossSheffi'd,com.	71½
Sloss Sheffield, pf.	‡117½
Tennessee Copper	‡25⅞
Utah Copper	43½
U. S. Steel, com.	78⅜
U. S. Steel, pf.	115⅞
Va. Car. Chem.	60

N. Y. CURB June 21

Name of Comp.	Clg.
Bonanza Creek	3
Boston Copper	18
Braden Copper	4¼
B. C. Copper	5
Buffalo Mines	‡2½
Butte Coalition	19¼
Caledonia	1⅛
Chino	11½
Cobalt Central	.11
Cobalt Prov.	59
Con. Ariz. Sm.	1⅛
Cumberland Ely	9
Davis-Daly	1⅜
Dominion Cop.	‡7
Ely Con.	.50
El Rayo	4⅜
Florence	2.22
Gila Copper	5¾
Giroux	7
Gold Hill	1⅞
Goldfield Con.	9¾
Greene Cananea	7⅝
Guanajuato	‡1⅜
Guggen. Exp.	185
Ker- Lake	.08⅜
La Rose	4½
McKinley-Dar-Sa.	.98
Miami Copper	20⅛
Mines Co. of Am.	64
Mont. Shoshone	⅞
Mont.-Tonopah	‡.70
Nev. Utah M. & S.	⅝
New Baltic	7
Newhouse M. & S.	3½
Nipissing Mines	11¼
Ohio Copper	1⅛
Pacific Sm. & M.	1/16
Ray Central	2⅝
Ray Con.	17
Silver Queen	‡.35
Standard Oil	620
Stewart	1⅛
Tonopah	9
Tonopah Ex.	‡.90
Tri-Bullion	⅝
W. Va. Wyo. Cop.	‡2 1/16
Yukon Gold	4⅜

LONDON June 22

Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 3 3
Camp Bird	1 8 0
Esperanza	2 13 9
Tomboy	1 0 0
El Oro	1 7 9
Oroville	0 6 0
Mexico Mines	8 10 0

BOSTON EXCH. June 21

Name of Comp.	Clg.
Adventure	5¾
Allouez	40
Am. Zinc	24½
Arcadian	5
Arizona Com	15¾
Atlantic	7
Boston Con.	‡17
Butte & Balak	15
Calumet & Ariz.	53
Calumet & Hecla	545
Centennial	16¾
Con. Mercur	.08
Copper Range	62¼
Daly-West	8
East Butte	8
Franklin	11½
Granby	38
Hancock	19½
Helvetia	2½
Indiana	16¾
Isle Royale	18
Keweenaw	3¼
Lake	53¾
La Salle	11
Mass.	8¼
Michigan	4½
Mohawk	48
Nevada	19½
North Butte	27
North Lake	11½
Ojibway	7
Old Dominion	35⅝
Osceola	132
Parrot	13
Quincy	71¾
Shannon	10¼
Superior	43½
Superior & Bost.	9⅞
Superior & Pitts.	10½
Tamarack	51
Trinity	5½
U. S. Smg. & Ref.	.40
U.S.Sm. & Re., pd.	48⅞
Utah Apex	3
Utah Con.	21½
Victoria	3
Winona	7¼
Wolverine	113
Wyandotte	1⅝

BOSTON CURB June 21

Name of Comp.	Clg.
Ahmeek	165
Bingham Mines	3
Boston Ely	2
Boswyocolo	.08
Cactus	2¾
Calaveras	7⅞
Champion	.05
Chemung	8
Chief Cons	1¼
Cons. Ariz.	2
Corbin	‡.06⅞
Crown Reserve	3
First Nat. Cop.	3½
Indiana	17½
Inspiration	8¼
Mackinaw	.06
Majestic	.50
Nat'l Mine	.25
Nevada-Douglas	2½
Oneco	3
Raven Copper	.27
Rhode Island Coal	7
San Antonio	7¼
Shattuck-Ariz	25
South Lake	5
Superior & Globe	.38
Trethewey	1¾
Tuolumne Copper	3½
Vulture	9⅛
Yuma	‡.70

‡Last quotation.

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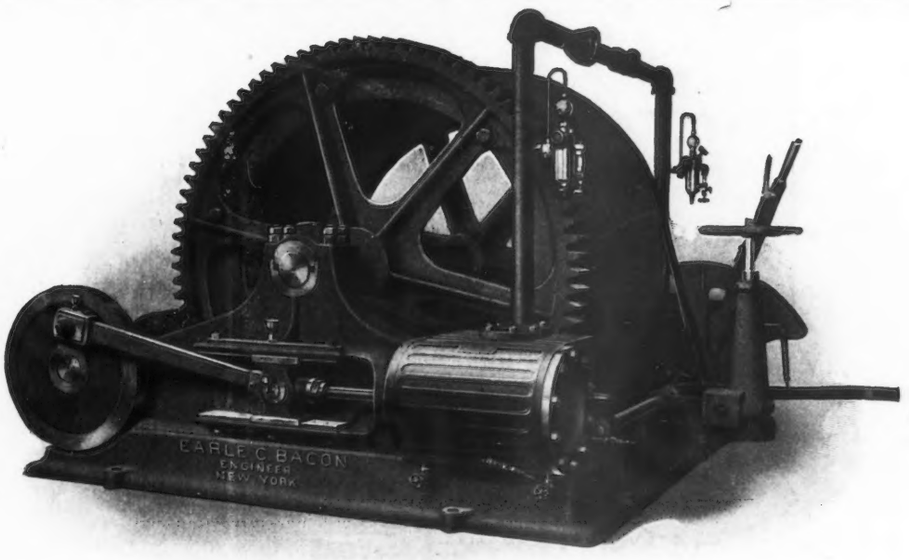

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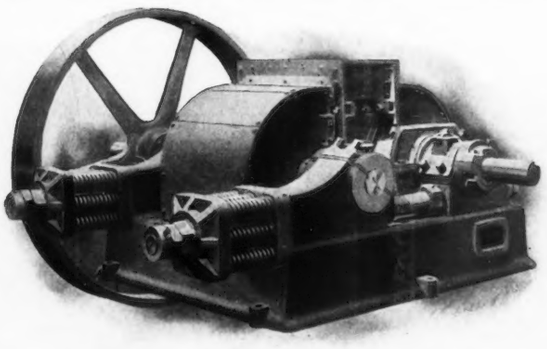

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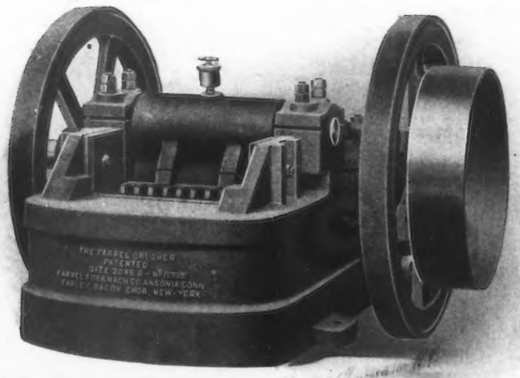

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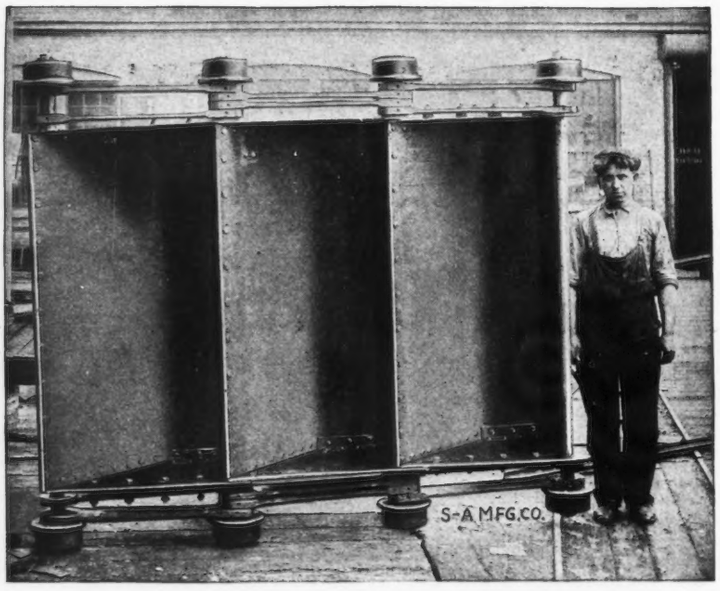

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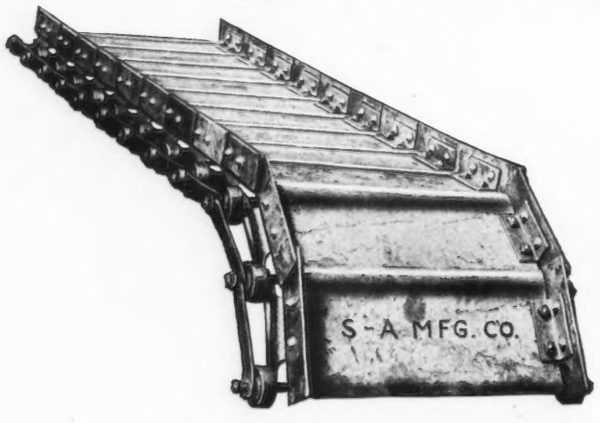

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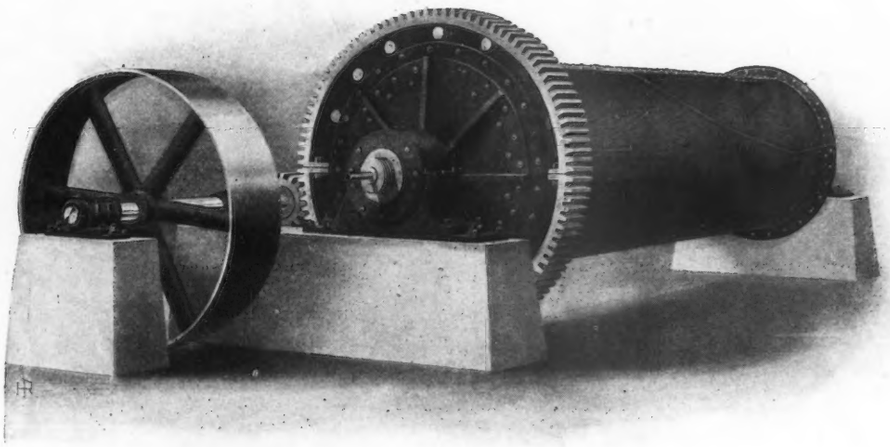
Inc.

Builders of

Mining, Cement and Crushing Machinery



Improved Tube Mills

The head bushing at feed end has R. H. Thread on inside to facilitate feeding pulp, and L. H. Thread on outside of portion projecting beyond trunnion, thereby aiding to keep dust and grit away from bearing which trunnion runs in.

Pebbles or Hard Rock for Crushing

can be fed through discharge end while mill is running.

Fitted with either El Oro or Silex Lining.

We build Tube Mills Sectionalized for Mule Back Transportation.

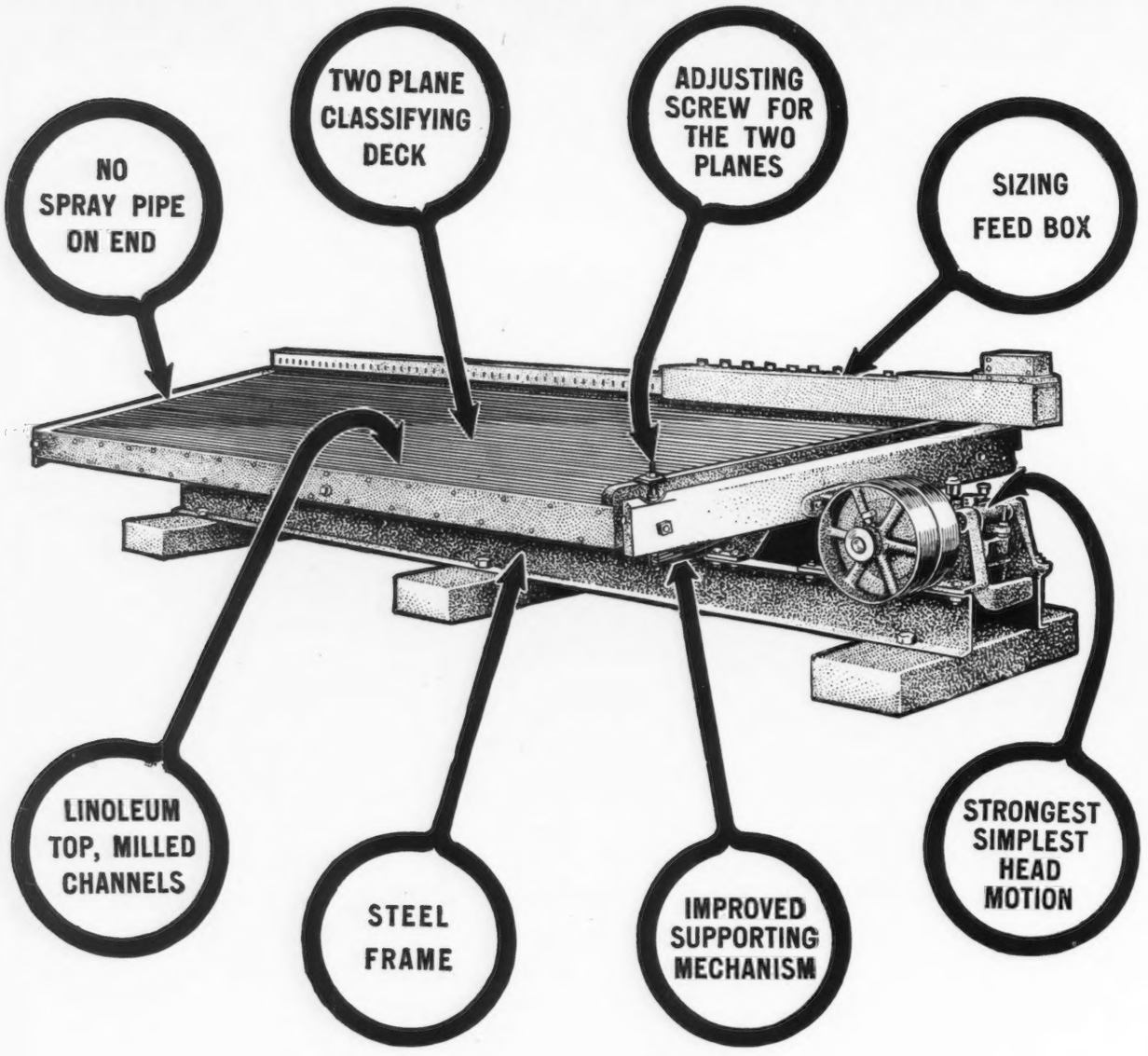
We invite your comparison with other types.

Write for descriptive matter.

General Office: 1925 Commercial Nat'l Bank Bldg., CHICAGO

New York Office: 120 Liberty Street

CARD CONCENTRATOR



There is nothing built that will equal the performance of

THE CARD CONCENTRATOR

Catalog on Request.

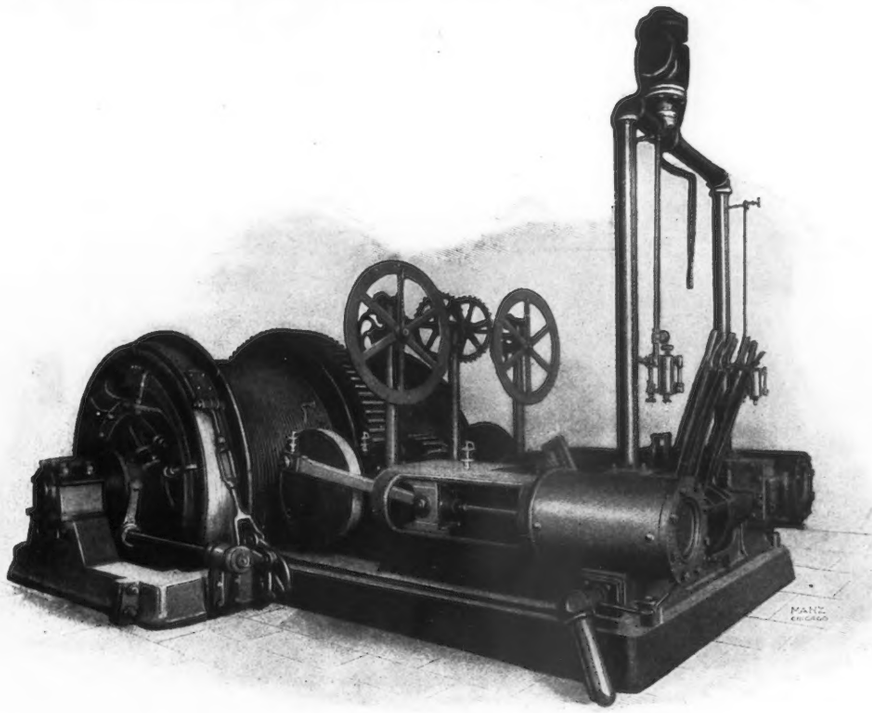
THE HENDRIE & BOLTHOFF MFG. & SUPPLY CO.

DENVER, COLORADO, U. S. A.

THE WELLMAN-SEAVER-MORGAN CO.

WELLMAN-SEAVER-MORGAN ENGINEERING DIVISION — ENGINEERS AND MANUFACTURERS — WEBSTER, CAMP & LANE DIVISION

STEAM HOISTS



"SIERRA" TYPE HOISTS:—

This type of hoist was developed to meet the demand for a hoist midway in cost between the Self-Contained and our well-known "IBEX" type. While it occupies more floor space than the self-contained hoist, it has the advantage of being a much quieter running machine, and the clutches and brakes are so placed as to give greater accessibility for adjustment and repairs. The arrangement further leaves the front end of the machine clear for the ropes, so that the lead of the ropes can be carried as desired. The machine can be fitted up with drums or reels—post or band brakes—steam operated auxiliaries for clutches and brakes.

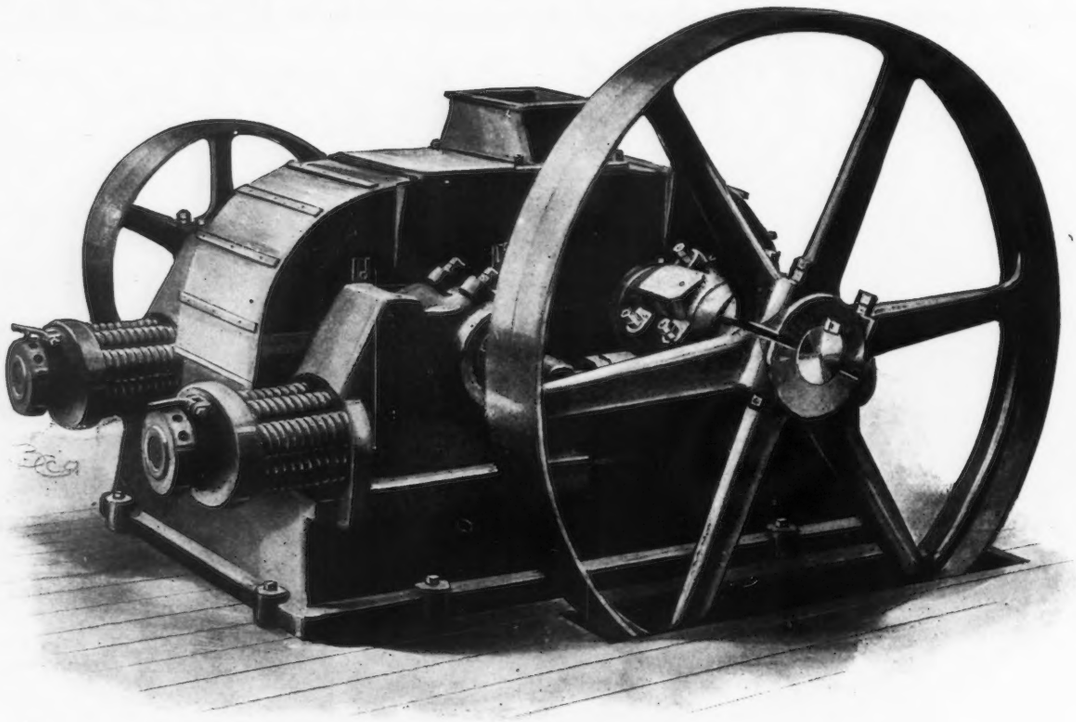
CATALOGUE H. O. 7

General Offices: Cleveland, Ohio, U. S. A.

BRANCH OFFICES:

NEW YORK, Hudson Terminal.
MEXICO, D. F., Apartado 1220—14 a de Guerrero 3326.
SAN FRANCISCO, Marvin Building.
DENVER, 611 Ideal Building.
LONDON HOUSE: Wellman-Seaver & Head Limited, 47 Victoria Street, S. W.

Superior Crushing Rolls



Power and Mining Machinery Co.

THE illustration above is of our Superior Crushing Roll. This type of roll is especially adapted, within certain limits, for crushing the oversize from the preliminary crushers. In fact, it is fast superseding auxiliary crushers for this purpose.

This machine requires less power to produce large quantities of comparatively finely crushed stone than any other type of re-crushing machine. There is also a great advantage in the one unit of enormous capacity such as our 54x24 inch roll has, over a number of smaller machines having more working parts, necessitating larger buildings, complicated driving arrangements, greater attention, etc., Correspondence invited.

Offices at New York, Chicago, El Paso, Atlanta, San Francisco.

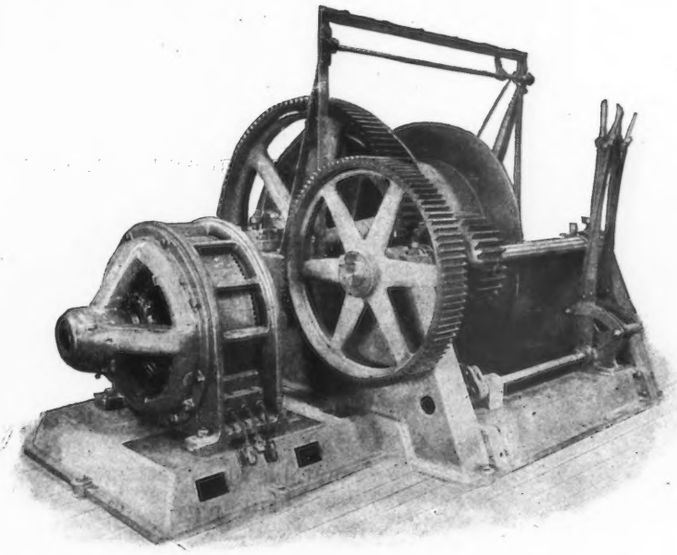
Principal Products

Rock Crushing Machinery — **Mining and Smelting Machinery**
Cement-Making Machinery
Wood Impregnating Plants — **Power Transmitting Machinery**
Loomis-Pettibone Gas Generators — **Suction Gas Producers**

Write for Catalogs on any of Above, Mentioning this Journal

General Office and Works: Cudahy, Milwaukee, Wisconsin

ELECTRIC HOISTS



This cut shows our single drum electric mine hoist for 5000 pounds rope pull as measured at the drum. This size of machine is the one to use for ordinary operations with a single deck cage and a one-ton car, as the load will then approximate:

Cage, 1100 lbs.; Car, 900 lbs.; Ore, 2000 lbs.; Rope, 600 lbs.
Total, 4600 lbs.

The satisfaction given by this hoist in service is shown by kind of mining companies that use it, as set forth in the following partial list of users.

SINGLE DRUM		DOUBLE DRUM	
Anaconda Copper M. Co.	1 hoist	Anaconda Copper M. Co.	3 hoist
Cananea Con. Copper Co.	3 "	Pedro Alvarado	4 "
Phelps, Dodge & Co.	4 "	Phelps, Dodge & Co.	4 "
Calumet & Arizona M. Co.	1 "	Guanajuato R. & M. Co.	1 "
Northern Pacific Ry. Co.	1 "	Northern Pacific Ry. Co.	1 "
Minas Tecolotes y Anexas	1 "	Bingham Con. M. & M. Co.	1 "
Mogul Mining Co.	2 "	Mineral Development Co.	1 "
Doe Run Lead Co.	1 "	Guanajuato Con. M. & M. Co.	1 "

THE DENVER ENGINEERING WORKS COMPANY

Denver, Colorado, U. S. A.

SALT LAKE CITY: District Office for - - - - - - - - Utah, Eastern Nevada, Western Montana, Idaho.

SAN FRANCISCO:
LOS ANGELES: } Sales Agents: Harron, Rickard & McCone for California, Western Nevada, Western Arizona.

MEXICO CITY: Sales Agents: Victor M. Braschi & Co. for Eastern, Central and Southern Mexico.

37

Let The Name "Wonder" Sink In Deep

We'll not beat around the bush. You haven't noticed our doing so since reading these ads., have you? When we have anything to say we come right out and give it to you straight from the shoulder.

Maybe this explains why our ads. are noticed—and read—and believed in. We know they're different from anything else in this paper, and what's more, the writer has heard quite a bit of favorable comment regarding them. All of which bears out our policy that the best thing to do when you have a story to tell is to come out and tell it in the open, hiding nothing.

And so we say that we want the name "WONDER" to sink in deep.

We want Wonder Rock Drills to be known wherever rock drilling is conducted. We want you to think "Wonder" and talk "Wonder." We want you to say "Wonder" whenever you are asked to name the best drill in existence. In short, we want the name "Wonder" to be as widely known in the specialized field of drilling as "Uneeda" is in the general field.

Now, we're not selling perfumed soap to women. We're trying to spread the fame of a cold, hard, matter-of-fact business proposition—one which appeals to a class of men we know can't be equalled for "levelheadedness."

Put a Wonder Rock Drill in your mine and see how it increases your tonnage, cheapens your costs and makes more money. Watch how easily one man can handle it. See how it cuts more feet of holes per day per cubic foot of air consumed than the two-man drill. See the advantages of the double air feed cylinder which permits the hose to be attached to the air feed cylinder rather than the drill, avoids swinging the hose with the drill, saves unnecessary labor of operator swinging, lengthens the life of hose and fittings, permits the drill cylinder and bit to be completely rotated, which gives a round, smooth hole, provides for a limited air supply while starting the drill hole, and has but one source of air supply with but one throttle regulating same.

And *then*—THEN acknowledge the Wonder Rock Drill to be superior to any drill you ever used. If it isn't, send it back—on us.

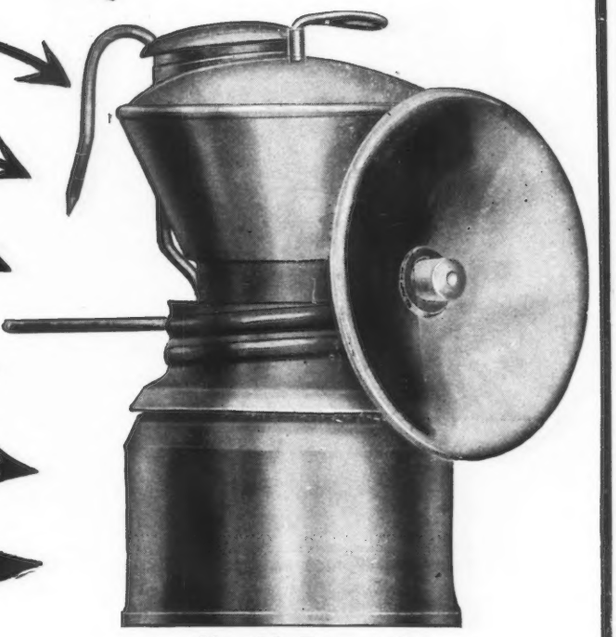
Hardsocg Wonder Drill Co.

Ottumwa, Iowa

A Few Of The Many Points In Favor Of The Baldwin Acetylene Mine Lamp

—oOo—

- Costs less to operate than oil or candles
- Produces 5 times more light than oil or candles
- Is perfectly safe
- Cannot explode
- More convenient to carry
- More convenient to fill
- Burns with absolutely no smoke
- Produces practically no noxious gases
- Can be refilled in the dark



No. 32 Patented
Actual Size, Weight 5 oz.

Eight Distinct Features
And A Dozen More Not Mentioned Here

Write us today to send you a dozen lamps on trial. You test them. if they come up to our claims you owe us for the lamps. If they don't send back the lamps and you owe us nothing.

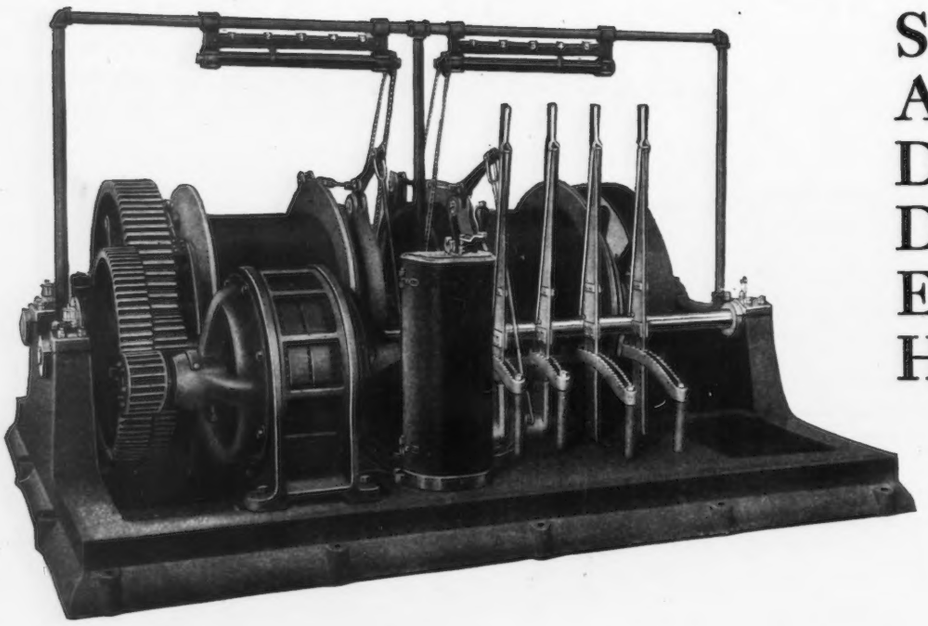
We pay transportation both ways on trial orders.

John Simmons Company

Manufacturers

102 Centre St. -:- **New York**

Branches: San Francisco, Cal., Butte, Mont.



Single And Double Drum Electric Hoists

The Mine and Smelter Supply Company

Salesrooms and Warehouses at

Denver, Salt Lake City, El Paso, City of Mexico

New York Office, 42 Broadway

OTTUMWA Electric Hoists embody the knowledge acquired during forty years' experience in the manufacture of Hoisting Machinery.

Ottumwa Electric Hoists have passed through the experimental stage—a large number are in successful operation throughout the mining districts.

For underground work, or for places at some distance from the location of the power plant, electric hoists are more economical than steam or air, as it is easier and cheaper to install wire than to lay pipes.

Ottumwa Electric Hoists are designed and built to meet operating conditions, and are as easily handled as steam-driven machines.

Electric hoists do not require skilled experts to operate or care for them—they are readily controlled and are not liable to get out of order. In controlling the speed of an electric hoist the handle of the controller is used the same as the throttle of a steam engine.

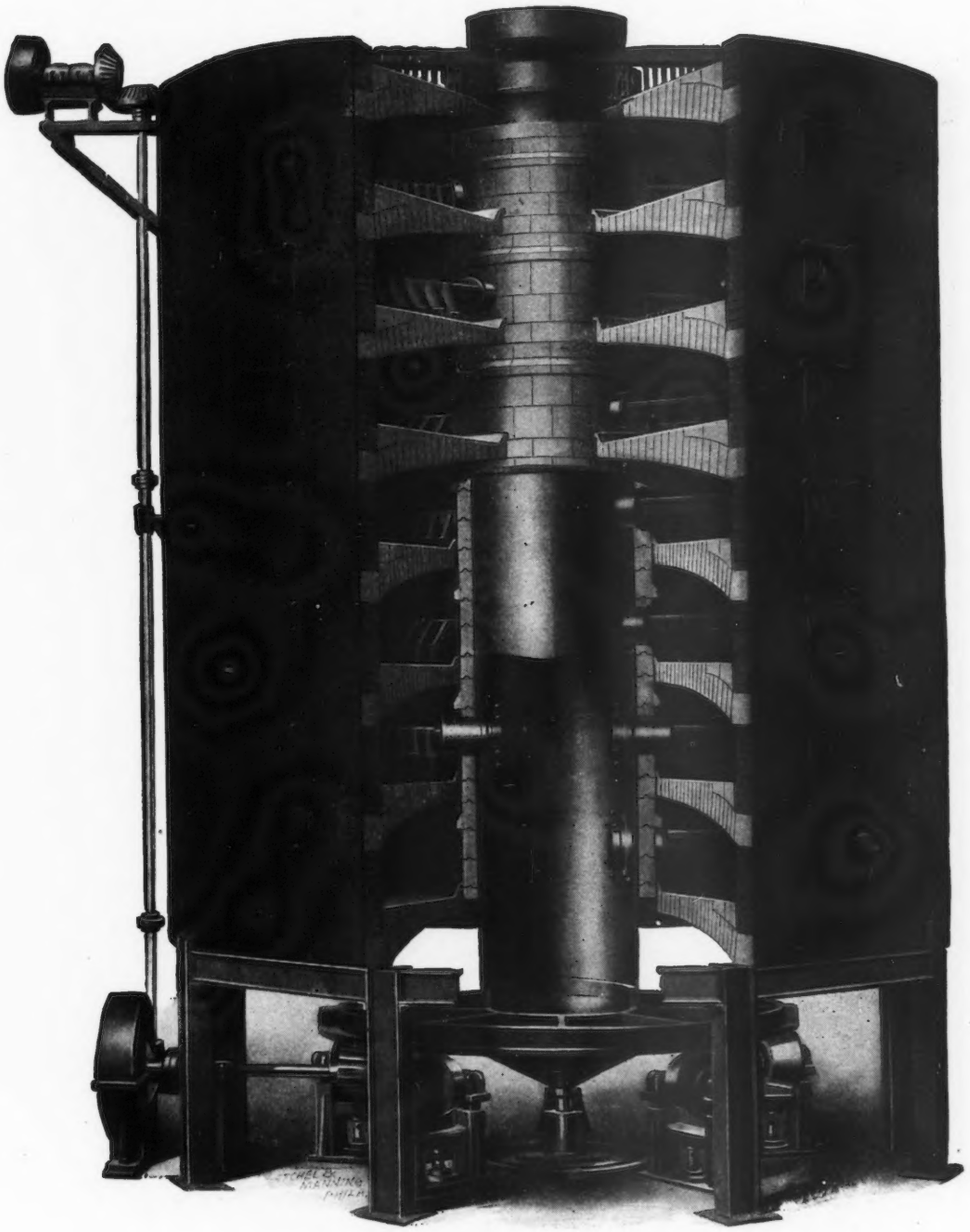
Either direct or alternating current at any of the standard voltages and frequencies may be used, and hoists can be built for any desired load and speed of rope. Correspondence invited. Please address nearest office.

THE LARGEST MINING MACHINERY AND SUPPLY HOUSE IN THE WORLD

SOLE MANUFACTURERS OF THE WILFLEY CONCENTRATING TABLE AND SLIME TABLE

The Wedge Mechanical Furnace

Patented



IF you desire a Furnace to successfully roast your ore and operate continuously for years, by all means install a Wedge Furnace. We will endeavor to show you why, if you will kindly write us stating your requirements. We await your reply.

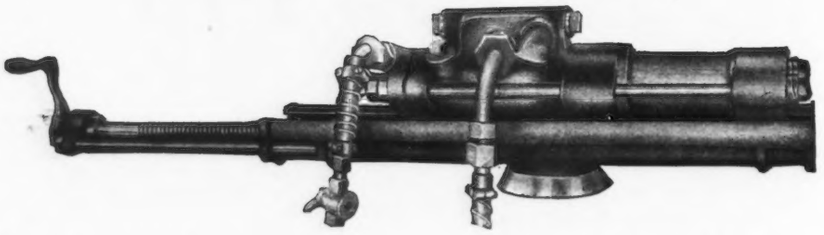
The Pennsylvania Salt Manufacturing Co.

Philadelphia, Pa.

THE LEYNER BULLETIN

June 25 Littleton, Colo., U. S. A. 1910

DRIFTING COSTS
CUT IN TWO.



One of the largest iron mining companies in the Lake Superior District recently installed No. 7 Water Leyner Drills, discarding 3¼" Piston Machines of a well known make.

The mine is noted for the extreme hardness of the country rock and ore, the latter being associated with Jasper. Miners operating heavy piston drills in Jasper Drifts on contract, were paid $14.00 per linear foot, until the advent of the Leyner Machines.

During the few months WATER LEYNER DRILLS have been installed, this company has REDUCED CONTRACT PRICES FROM $14.00 TO $7.00 PER FOOT, and yet the miners make higher wages than ever before, to say nothing of the fact that their health is no longer endangered by deadly dust from piston machines.

DO YOU WISH TO OBTAIN SUCH RESULTS?

We will be glad to tell you how it was done in the above instance.

The J. Geo. Leyner Engineering Works Company,

General Offices and Works: LITTLETON, COLO., U. S. A.

BRANCHES OR AGENCIES IN ALL PRINCIPAL MINING CENTERS.

Manufacturers of a complete line of HAMMER DRILLS, covering the entire field of rock drilling; Drill Sharpeners, Air Compressors, Oil and Coke Furnaces, Steam and Electric Hoists, Cars, Cages, Skips, Etc.

ASK FOR THE CATALOGUES

17

25 lbs.—Steel Keg.

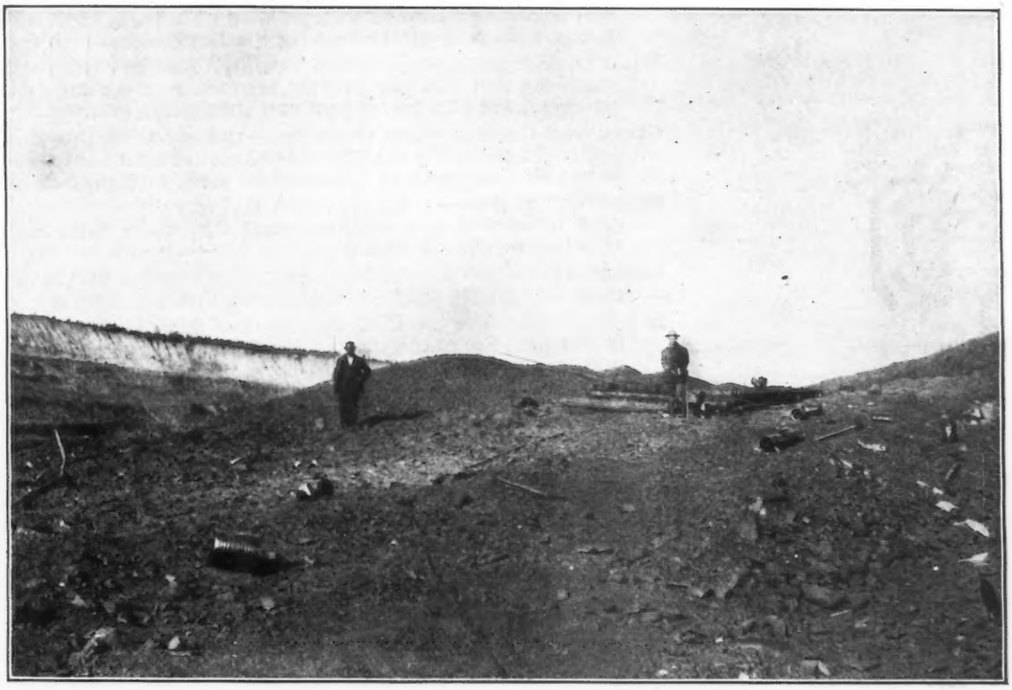
DU PONT

Blasting Powder

25 lbs.—Pulp Keg

For

Open Ore Mining and Stripping



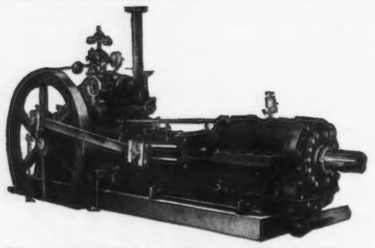
A "Good Shot" with Du Pont R. R. Blasting Powder in a Minnesota Open Ore Mine.

40% Red Cross Ammonia Dynamite Is Recommended for Chambering or "Springing" Bore Holes.

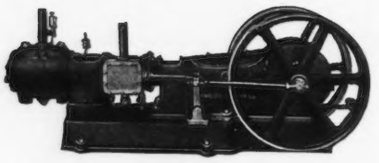
Write for Catalogue

E. I. du Pont de Nemours Powder Company

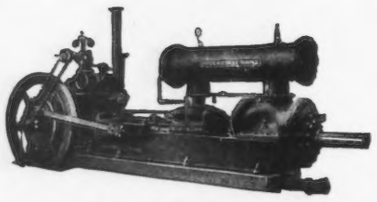
Established 1802 **Wilmington, Del., U. S. A.**



Class "A-1" Steam Driven Single Stage Straight Line: Twenty-Seven Sizes; Capacities 285 to 1357 Cu.Ft. per Minute; Pressures 10 to 100 lbs.



Class "NF-1" Steam Driven Straight Line; Fourteen Sizes: Capacities 42 to 627 Cu.Ft. per Minute; Pressures 15 to 100 lbs.



Class "AA-2" Two Stage Straight Line; Six Sizes; Capacities 690 to 2178 Cu.Ft. per Minute; Pressures 90 to 110 lbs.

COMPRESSORS

If you were in Chicago, or New York, or Philadelphia—and you had a very particular thing to buy—where would you go to find it?

Would you stop at the first small shop and be limited in your choice to what its small stock offered?

Wouldn't you, rather, go to Marshall Field's, or Wanamaker's, **where you know you can find the very thing you seek, with a name and a reputation to guarantee its quality?**

When we offer you a compressor of "quality" for every duty, we are simply suggesting that you buy your air compressor on the same principle—**by going where you know you can find what you want.**

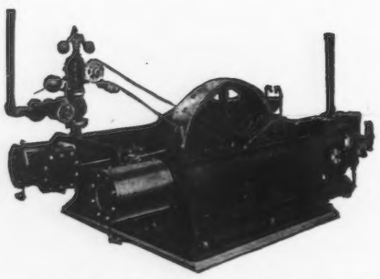
Glance over the illustrations shown here—and remember that these are only twelve of the **twenty standard Ingersoll-Rand compressor types** to be had in **more than a thousand sizes and modifications.**

Remember that there is a definite reason for every type—that each was developed to meet certain conditions—and that under those conditions the very best results will be had.

Remember that the engineers who designed these machines have been in intimate touch with mining developments for more than a generation.

In other words, there are thirty-nine years of mining experience represented in this great line of compressors, the development of which has kept pace with the advance in mining methods.

Probably more than fifty per cent of the world's coal and ore tonnage is today being produced by coal cutters and rock drills supplied from Ingersoll-Rand Air compressors.



"Imperial X" Duplex Meyer; Forty Sizes; Capacities 120 to 4763 Cu.Ft. per Minute; Pressures 15 to 100 lbs.

ROCK DRILLS **"ELECTRIC-AIR" DRILLS** **HAMMER DRILLS**
COAL PUNCHERS **COAL SHEARERS** **"RETURN-AIR" PUMPS**

INGERSOLL-

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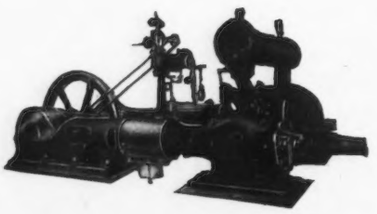
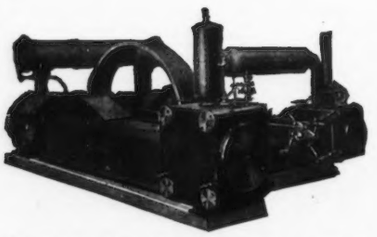
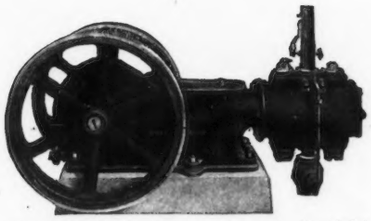


Class "O" Duplex Meyer; Fifty-Four Sizes; Capacities 522 to 5190 Cu.Ft. per Minute; Pressures 15 to 125 lbs.



"Imperial XC" Corliss Duplex; Twelve Sizes; Capacities 1312 to 3765 Cu.Ft. per Minute; Pressures 15 to 100 lbs.



Class "NE-1" Power Driven Straight Line; Fourteen Sizes; Capacities 42 to 627 Cu.Ft. per Minute. Pressures 15 to 100 lbs.

"Imperial XI" Vertical Duplex Power Driven; Ten Sizes; Capacities 16 to 284 Cu.Ft. per Minute; Pressures 15 to 100 lbs.

OF "QUALITY"

The largest compressor-building shops in the world are kept busy by the increasing demand for Ingersoll-Rand Compressors.

This vast business has been built upon one fundamental principle—that of giving maximum continued satisfaction to the user of Ingersoll-Rand Compressors.

The world-wide recognition accorded Ingersoll-Rand Compressors as **standards for mining service** is simply an endorsement of the **quality** which distinguishes them.

For the good buyer is just in his estimates of value. He distinguishes between "worth" and "price."

He knows that the reputable builder has based his reputation on the **quality** which has made that **reputation.**

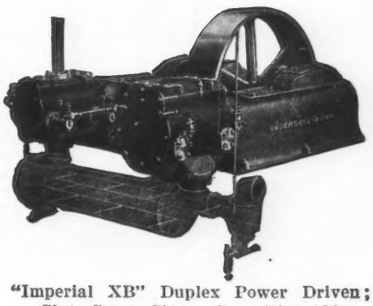
The good buyer knows that that reputation is the builder's greatest asset and the buyer's greatest security.

He knows that **the price asked by the reliable builder for his product is a true measure of its value to the buyer.**

When you buy an Ingersoll-Rand Compressor you are buying **a quality product.**

You will secure, from a widely diversified **standard** line, a **standard** compressor at a **standard** price, which you may know represents **maximum value.**

And thereafter you will be protected, in your purchase, by the guarantees of the oldest, largest and most responsible builders of Air Compressors in the world.



"Imperial XB" Duplex Power Driven; Sixty-Seven Sizes; Capacities 120 to 4763 Cu.Ft. per Minute; Pressures 15 to 100 lbs.

PLUG DRILLS **"CALYX" CORE DRILLS** **TAMPING MACHINES**
AIR LIFT PUMPS **PNEUMATIC TOOLS** **PNEUMATIC HOISTS**

RAND CO.

LONDON

Foreign Offices:

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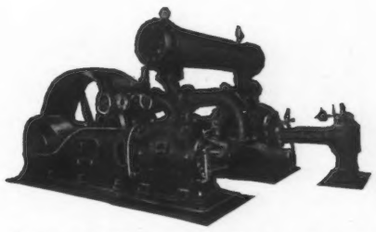
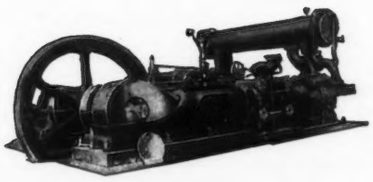
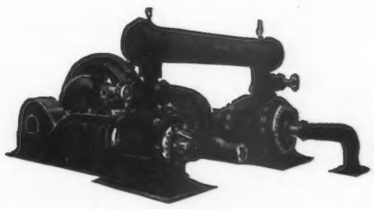


Class "PB" Duplex Power Driven; Forty-Two Sizes; Capacities 700 to 5200 Cu.Ft. per Minute; Pressures 70 to 125 lbs.



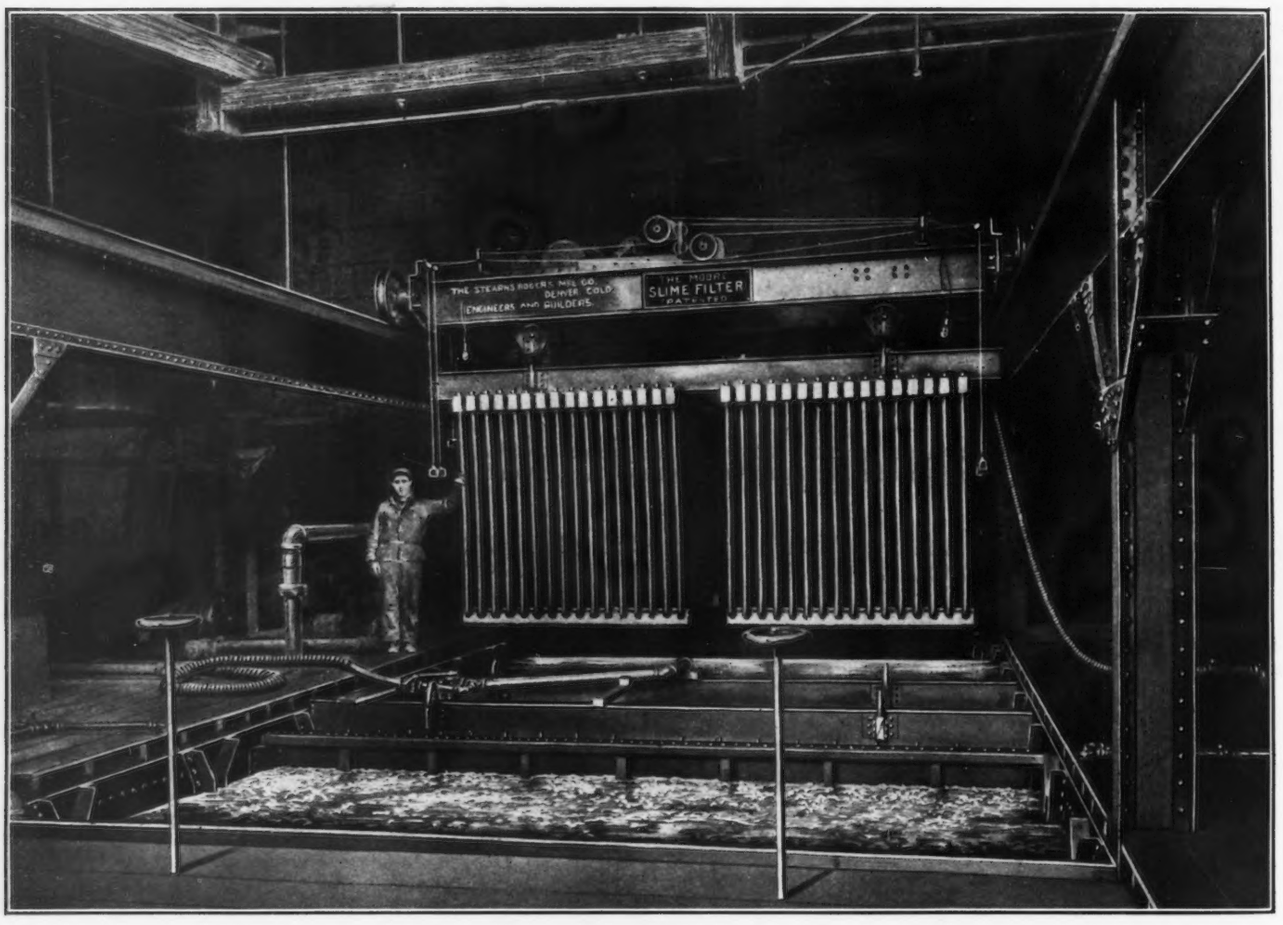
Class "OC" Corliss Duplex; Forty Sizes; Capacity 1412 to 8037 Cu.Ft. per Minute; Pressures 15 to 125 lbs.



Class "PE" Duplex Electric Driven; Forty-Two Sizes; Capacities 800 to 5700 Cu.Ft. per Minute; Pressures 70 to 125 lbs.

The Moore Slimes Process

Photo shows installation at the Golden Reward Consolidated Gold Mining and Milling Company, Deadwood, South Dakota—"*Average* assay value of Tailings discharged, 4 cents per ton."



The Moore Filter Co.

This Company either **Exclusively Owns** or **Exclusively Controls**
The Moore-Cassel-Clancy Patents and Pending Applications.

Cable: Morefilter New York **New York, U. S. A.** Code: Bedford-McNeill

Carnegie Steel Company

General Offices: Pittsburgh, Pa.

Steel Mine Timbers

The Photograph shows pump house, Pennsylvania Coal & Coke Co., Ahrenfeld, Pa. A structure framed in steel, covered with steel and absolutely fireproof; a structure easy to fabricate and erect, and truly economical in all respects. A structure of this kind commands and will repay the closest investigation by mine owners and operators who have had experience with mine fires.

For information apply to

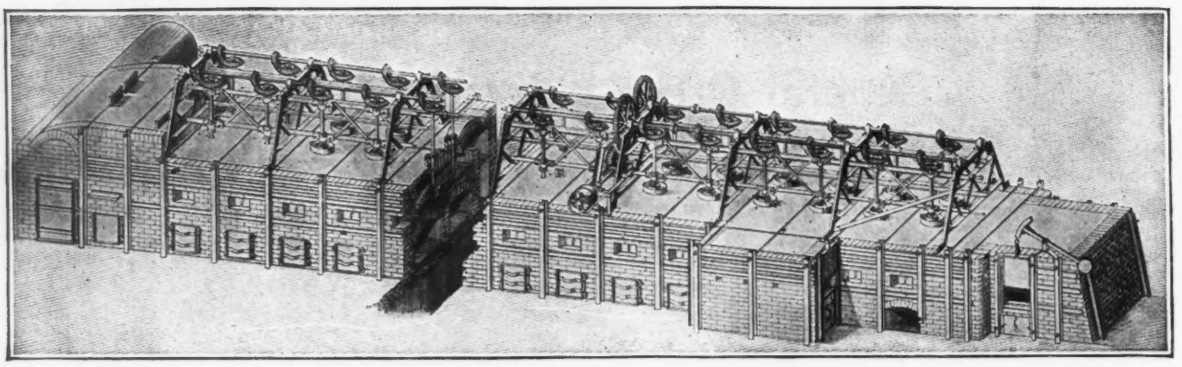
Carnegie Steel Company

Birmingham	Cincinnati	New Orleans	Portland
Boston	Cleveland	New York	San Francisco
Buffalo	Denver	Philadelphia	St. Louis
Chicago	Detroit	Pittsburgh	St. Paul

Export Representatives: United States Steel Products Export Co., New York

4-1

Economy In Labor, Fuel And Maintenance.



The Edwards Patent Mechanical Ore Roasting Furnace uses no fuel whatever but that to be found in the ore where sulphur obtains in any quantity and less fuel than any other furnaces where there is any sulphur at all.

The "Edwards" has a record for extracting 98% of all the gold in the ore. The mechanism is very simple and requires practically no attention after starting.

It will bear the closest investigation because THERE IS NO OTHER JUST AS GOOD.

Write for descriptive matter and further information.

Chisholm, Matthew & Company, Agents,
Colorado Springs, Colo.
T. EDWARDS, Ballarat, Australia, Patentee and Owner.

G. E. Centrifugal Air Compressor Direct Driven by Curtis Steam Turbine.

Twenty-four Days' Continuous Service Without Attention

A G. E. Air Compressor installed on a large ocean steamship for supplying the air blast to its oil-fired furnace made this remarkable record. In speaking of the performance, the engineer said: "From the time it was installed, during the entire voyage of twenty-four days, the compressor required **no attention whatever.**"

General Electric Centrifugal Air Compressors

(Electric Motor or Steam Turbine Driven) Have characteristics which **insure** reliable operation. Two valuable features are:

No Wearing or Rubbing Parts Due to the absence of wearing or rubbing parts, there is no leakage and consequent falling off in pressure and output, no matter h w long the compressor is in operation.

A Single Shaft The impeller of the compressor and the rotor of the driving apparatus are on the **same** shaft. The cumbersome and noisy gear or belt-driven apparatus has no comparison with the G. E. Centrifugal type in economy of operation or freedom from breakdown.

Let us send you Bulletin 4564, which describes these remarkable compressors in detail.

General Electric Company

LARGEST ELECTRICAL MANUFACTURER IN THE WORLD.

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2434

The Base Ball Season Does Not Affect The STROMBERG-CARLSON Mine-A-Phone

No. 890 TYPE

KEY LOCK

You never know the "curves" of the messenger boy. He will let the message look after itself while he does whatever suits his own sweet will.

Contrast this antiquated method of delivering messages with the modern way—the STROMBERG-CARLSON way.

The STROMBERG-CARLSON Mine-A-Phone brings all parts of the mine to the superintendent's desk *at once*. He can deliver his orders direct and instantly.

And yet the STROMBERG-CARLSON Mine-A-Phone costs little to install.

Send For Our Bulletin No. 1000-A And Prices.

¶ The STROMBERG-CARLSON Mine-A-Phone is acid-proof, water-proof and gases proof. It is especially built for mines and outdoor uses where an instrument is subject to the severest atmospheric conditions.

Send us the plans of your mine and works and we'll give you a definite estimate of the cost of installing it.

STROMBERG-CARLSON TEL.MFG.CO

ROCHESTER, NEW YORK, U.S.A.

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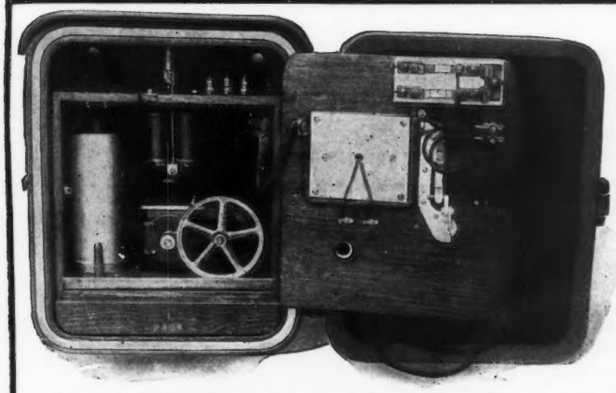


Open view of Kellogg mine telephone showing open inner door and compact arrangement of apparatus.

MINE CONTROL—

is the keystone of successful operation in these days of sharp competition and high wages. Mine control is profit and loss-dollars and cents in or out of your pocket, Mr. Operator. The hours saved in a telephone equipped mine—and therefore the money saved—is unbelieveable until you have tried the modern mine communication method, the Kellogg System. It is simple, easily understood and easily installed.

Kellogg mine telephones are not affected at all by atmospheric conditions underground or above ground.

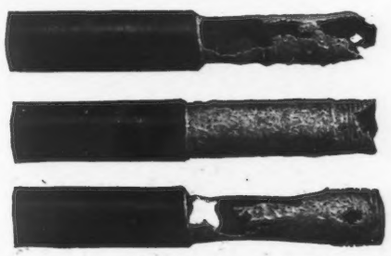
Our mine telephone booklet, No. 17, illustrates and explains the Kellogg system.

KELLOGG SWITCHBOARD & SUPPLY CO.

Kansas City, Mo. Chicago San Francisco, Cal.

Highland Non-Corrosive Coating

The only *guaranteed* protection for iron pipes against acidulated mine water, on the market.



It is applied just like paint, is always ready for use. In ordinary service, it prolongs the life of the pipe indefinitely. Subject to the mine service, makes pipe last its natural life.

First orders sent on approval.

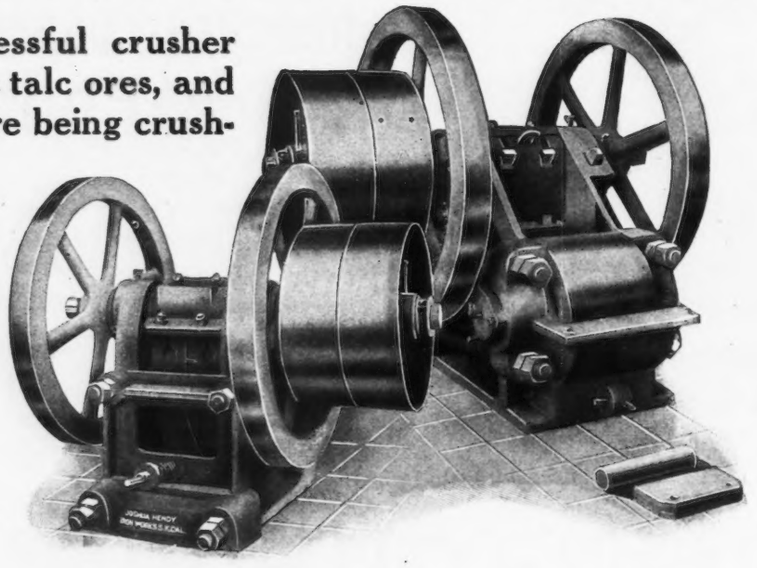
Write today for full particulars.

Highland Products Co.,

Connellsville, Penn.

Hendy Roller-Jaw Crusher

An exceptionally successful crusher for use on wet, clay or talc ores, and for fine crushing, the ore being crushed between the shoe and revolving die.



Made in 3 Sizes

No. 2 . .	6 in. x 12 in.
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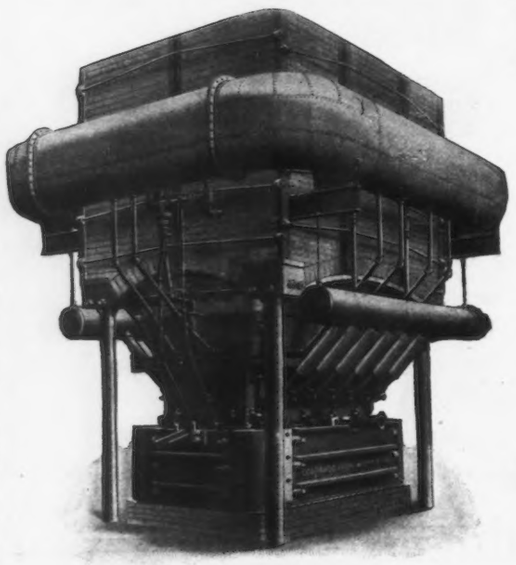
We build 2 sizes "sectional" for muleback transport.

Made By

Joshua Hendy Iron Works, San Francisco, Cal.

1860 **COLORADO IRON WORKS COMPANY** 1910

ORE SMELTING EQUIPMENTS — ORE MILLING MACHINERY



Smelting Furnaces

We were pioneers in the building of blast furnaces for smelting copper, lead, silver and gold ores and have made this a specialty for many years. Intimate knowledge of the metallurgical requirements and a sustained effort to excel in this line have caused our productions to stand pre-eminent as the most advanced examples of this class of equipment.

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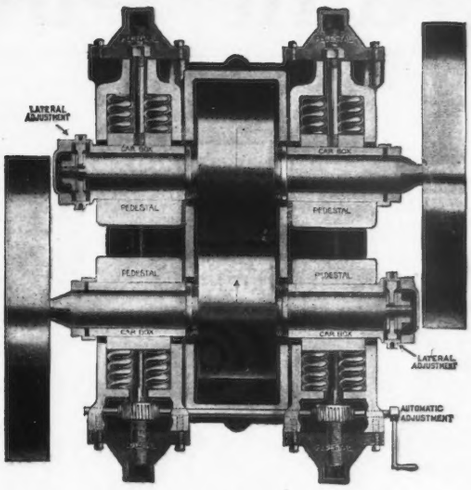
CRUSHING ROLLS



With "SAFETY VALVE" RELIEF

All of the advantages of Rigid Rolls with none of their serious faults. No crystallization of shafts—no stalling or breakage from over feeding or from metal getting between the tires.

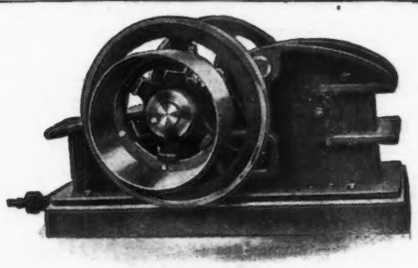
The same even product as obtained from Springless Rolls because our Springs only give back under breaking strains—no properly fed ore can move them.

All Crushing shocks are balanced and absorbed as all four bearings have Spring relief.

STURTEVANT MILL CO., BOSTON, MASS.

BUCHANAN (Style B)
ALL-STEEL ORE CRUSHER

Simplest, Strongest and Most Durable Machine Made.



The frame is a solid steel casting made in one piece. The pitman and swing jaw are made of solid open hearth steel castings. All joints are machined. The crusher can be adjusted to crush fine or coarse. It is free from light and trappy connections. The head room required is low, making it convenient to feed and especially desirable for mining purposes. The eccentric shaft is of the best quality of hammered steel and made extra long so that a pulley can be placed upon it for operating a screen or an elevator, if necessary. The jaw plates are of chilled charcoal iron, manganese or hardened steel. All wearing parts can be reversed.

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Crushing Rolls: 18″x12″ to 60″x60″.

Magnetic Separators, Wet or Dry. *Send for Catalog.*

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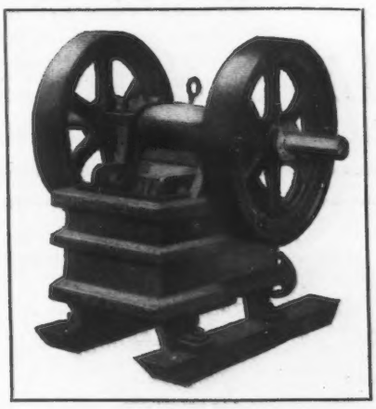
Mitchell's Improved Crusher

The One Crusher To Reduce Materials To A Uniform Size

Can be adjusted to crush rock or ore to any desired size, *while in operation.*

Requires less power, one machine performing the work which usually requires two.

Has only 14 parts and is exceedingly durable.



This is but the beginning of the "reasons why." We'll gladly give you all the facts, if you will write for Catalcg 5 M.J.

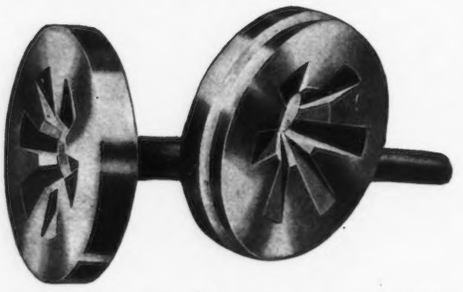
Eureka Stone and Ore Crusher Co.

Cedar Rapids, Iowa

Sales Agents—The Barron & Cole Co., Barron Bldg., New York, N.Y. Mr. W. J. Dickson, Fitzsimmons Bldg., Pittsburg, Pa. Harris Bros., Salt Lake City, Utah.

The Braun Pulverizer

Let us send you our complete descriptive booklet



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It is the greatest Labor Saver you ever installed in your laboratory.

It represents a permanent investment that will soon earn its initial cost and create a saving in your operating expenses.

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CYANIDE TREATMENT A SPECIALTY

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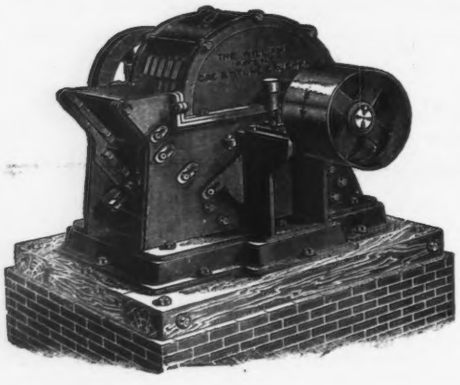

Why Experiment With Coal Crushers

when you can buy the Williams Patent Hammer Crusher and operate your plant every day in the year.

Any Capacity or Fineness.

Used by coke makers and for anthracite mine debris. 1550 machines in daily operation. *Write for Catalog* 5.

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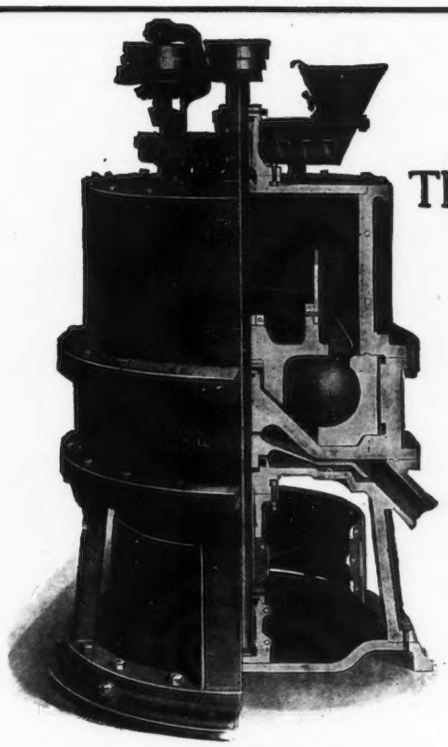

Extract All The Values

BY USING

THE FULLER-LEHIGH MINING MILL

for pulverizing your ore. The finished product delivered by this machine contains the highest percentage of mineral available for extraction, and makes extraction of all the values possible.

GRINDS EITHER WET OR DRY
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ANY DESIRED FINENESS

from 60 to 150 mesh. In one operation and without subsequent screening, it takes ¾" material direct from crushers and delivers 4 to 6 tons per hour with a consumption of less than 65 H.P.

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FARREL ORE AND ROCK CRUSHER

USED IN ALL PARTS OF THE WORLD—LARGE RECEIVING CAPACITY—SPECIALLY DESIGNED AND CONSTRUCTED FOR HARDEST KIND OF WORK

COMPLETE CRUSHING PLANTS OUR SPECIALTY

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Carlin's Grinding Pans And Crushers

The Superior Design and Extra Heavy and Thorough Construction of The Carlin Grinding Pans and Crushers are features well worth your consideration. *Write and get full details.*

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The Driving System Of This Tube Mill

was patented August, 1907. We send these mills out under guarantee of a saving of 30% in H.P. over the Trunnion type of Tube Mill.

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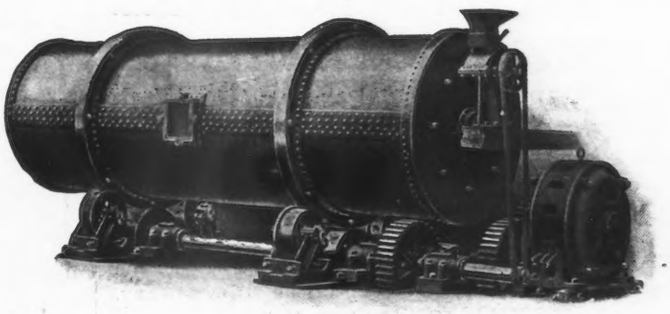

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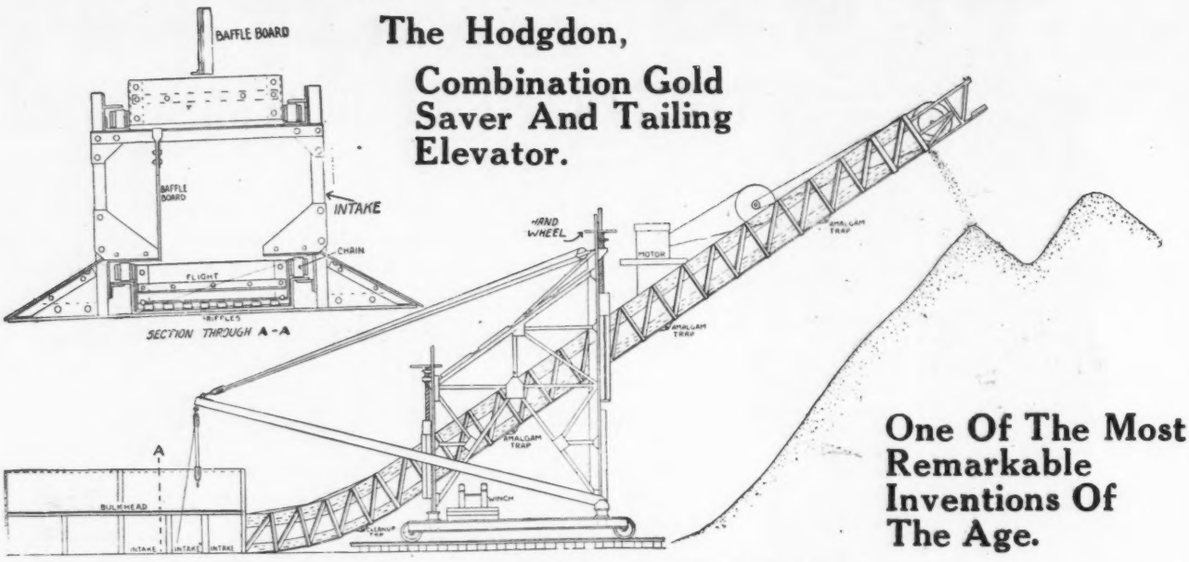
Placer Mining Revolutionized By This Machine



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Combination Gold Saver And Tailing Elevator.

One Of The Most Remarkable Inventions Of The Age.

HERE'S WHAT IT DOES!

Increases the efficiency of the miners inch about 400 per cent.
Solves the problem of economical disposal of tailings.
Doubles the gravel capacity of the giant nozzle.
Mines as readily on flat as inclined bedrock.
The Hodgdon is made of small light parts, and is easily transported overland.
It costs only one tenth as much as a dredge of the same capacity.
For free prospectus and story of the invention and successful use of this remarkable machine apply to,

The Moran Company, Sole Manufacturers, Seattle, Wash.

DORR Classifiers Thickeners

Ten of our Classifiers and 8 large Thickeners have just been ordered by the Santa Gertrudis Company, Pachuca, Mexico.

These devices are indispensable for Cyanide Plants.

Write for valuable data giving actual results obtained in many mills.

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Rings, Tires and Dies for Crushing Machinery.

"Standard" Roll Shells, Rings and Dies

of tire steel. The same method is followed as in the manufacture of steel locomotive tires, thereby assuring solid, weldless material to correct sizes, and of unsurpassed quality.

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A Grinder for all kinds of ores

Especially adapted for grinding ores for **CYANIDING**

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A Mill With A Capacity Of 40 Tons A Day

The repairs on the Lane Slow Speed Mill will not exceed 4 cents per ton of ore milled. It is an economical mill in every way.

Full details on request.

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Briquetting Machinery

CONVERT YOUR FINES INTO LUMP ORE.

Chisholm, Boyd & White Company,
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Demonstrating Works: 139-141 West Oxford St.,

No tankage--continuous, automatic, economic. Minutes instead of days or weeks.

If you can't get your values, consult us. Send us an average sample of 100 or 200 pounds of your ore or tailings, direct to our mill (139-141 W. Oxford St.), freight prepaid.

We treat it by our process and inform you of the results. If a cyanide proposition, we will surprise you.

Mark it well so it will not be mixed with others.

The first plant is ordered by the Gold Ridge Mine of Alabama.

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Ores treated by our new Process:

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Eckert vein, headings	$46.51	
Eckert vein, tailings	2.30	$44.21
Blue vein, headings	$34.09	
Blue vein, tailings (silver)	.20	$33.89
Black vein, headings	$49.00	
Black vein, tailings	2.51	$46.49
This is sulphide ore with coarse and free panning gold.		
MesaRicaG.M. (Mexico)head'gs	$29.25	
Mesa Rica G.M. (Mexico) tailings	1.85	$27.40
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Oregon ore, headings (refractory)	$ 2.57	
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Colorado ore, tailings	trace	total
Georgia ore, headings	$ 6.10	
Georgia ore, tailings	trace	total
Reliance M. & M. Co., headings	$16.00	
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North Carolina ore, headings	$2.16	
North Carolina ore, tailings	trace	total

Send for booklet and information.

CHROME STEEL WORKS

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(FORMERLY OF BROOKLYN, N.Y.)

TRADE **Adamantine** MARK

Chrome Steel Shoes And Dies

(Hydraulic Forged)

These Shoes and Dies are compressed hot under enormous pressure, in a Hydraulic Forging Press. This process of manufacture removes from the metal all internal shrinkage, porosity, etc., and insures a steel of absolutely equal density throughout the mass.

Shoes and Dies forged in this manner will *wear evenly to the end* and will give *longer service* than any make of cast or hammered material.

"Chrome Steel Stamp Mill Parts"

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You, of course, want the steel that will give longest service.

But are you sure you are getting it?

Even if you're using a very good steel it may not be adapted for the purpose for which you are using it.

But you can get the right steel for the right place—very easily.

TRADE TISCO MARK

Just Let Your Order Call For TISCO Steel

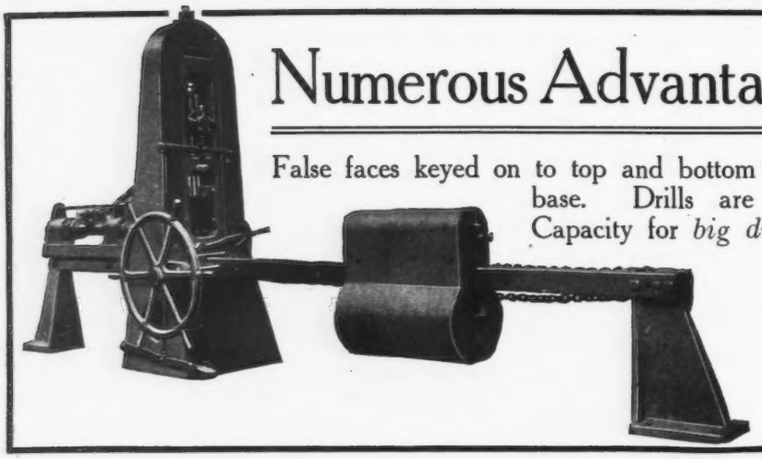
Here we have some of the best steel experts in the country. Their advice is at your disposal.

For years we have specialized on supplying the right steel—right in hardness, toughness, strength and ductility—for the special place and especially for severe service.

We have accordingly reduced a great many people's repair expenses. Probably we can reduce yours. *Write us.*

Taylor Iron & Steel Co.

High Bridge, New Jersey



Numerous Advantages Of The **Numa**

False faces keyed on to top and bottom dies. Minimum vibration because of anvil base. Drills are upset and flanged in the same recess. Capacity for *big dull drills* 3½″ in diameter 200 per hour.

The

Numa Rock Drill Sharpener Co.,

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Machines in stock ready for immediate shipment.

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Weight 3,078 Karats

Largest carbon ever found, ¼ actual size. Sold by us Sept. 24th, 1895.

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We make the most complete line in the world. Hand Power, Horse Power, Gasolene, Steam, Air, Electricity, Hydraulic Feed, Screw Feed.

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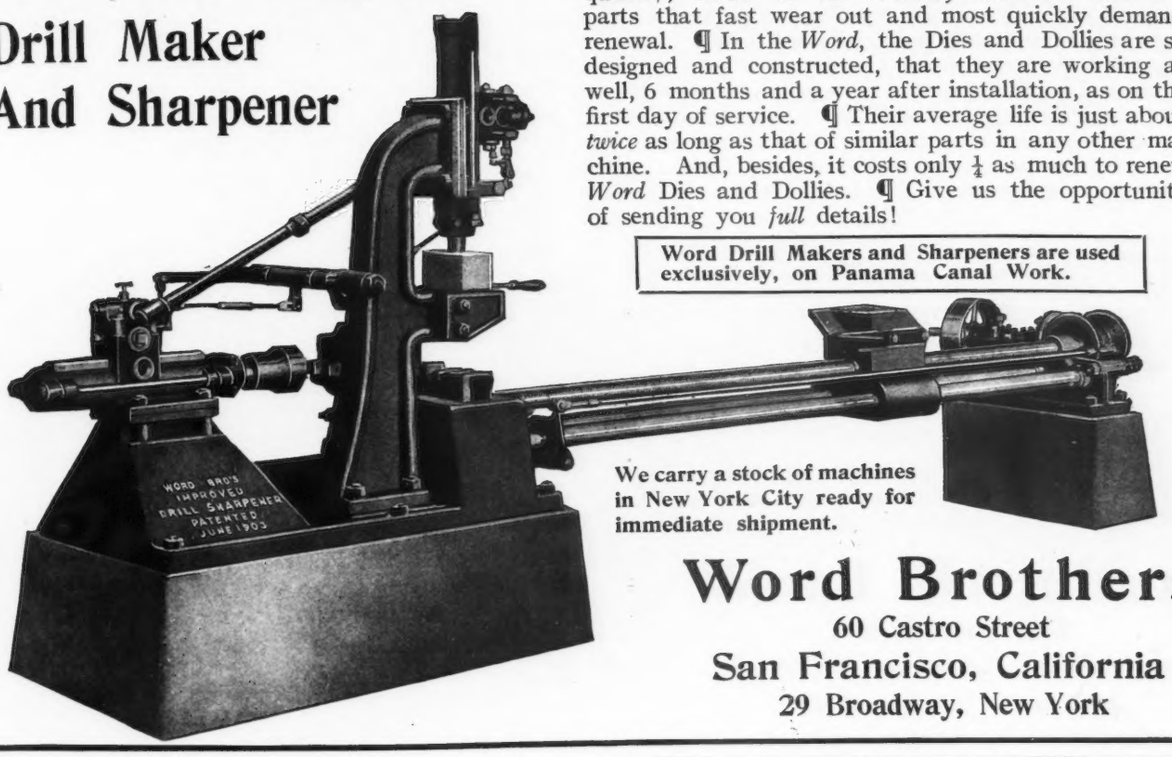
Drill Maker And Sharpener



Dies and Dollies with Double Lives

¶ The *hardest* wear in a Drill Making and Sharpening Machine, falls upon the Dies and Dollies. ¶ Consequently, these—in the *ordinary* machine—are the parts that fast wear out and most quickly demand renewal. ¶ In the *Word*, the Dies and Dollies are so designed and constructed, that they are working as well, 6 months and a year after installation, as on the first day of service. ¶ Their average life is just about *twice* as long as that of similar parts in any other machine. And, besides, it costs only ¼ as much to renew *Word* Dies and Dollies. ¶ Give us the opportunity of sending you *full* details!

Word Drill Makers and Sharpeners are used exclusively, on Panama Canal Work.

We carry a stock of machines in New York City ready for immediate shipment.

Word Brothers

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Acorn Drill Steel

Especially Recommended for Mining Drills

MADE in Sweden from the best Swedish charcoal iron, this steel combines strength and tenacity to an unusual degree. It is a superior grade of tool steel adapted for drilling work in all mining operations—its price is moderate.

Carried in stock in practically all shapes and sizes—Round, Square, Flat, Octagon, Cruciform and Hollow.

We handle, besides SISCO Tool Steels, Iron and Steel Chain, Charcoal Bar Iron and Solid Steel Anvils all made in Sweden from the highest grade ores.

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Delays Are Costly

In other words, if you are not using "Cleveland" Stope Drills in your Stopes, you are not getting as much work done, and it is costing more per foot of hole drilled than it should—so every day you delay ordering a "Cleveland" Stope Drill you are losing money.

Do you think this is "hot air"?

We are ready to prove our claims by referring to *any* customer in the U. S., Canada or Mexico, or by actual demonstration, for we will send you a machine, and let you decide for yourself whether it will do what we claim.

We are after your stope drill business, and will have it all if you will

Try A "Cleveland"

Write us now—don't delay—for delays are costly.

Bulletin No. 40-A.

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Hawthorne Ave.
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Murphy Rock Drills

Stopers Sinkers Drifters **Valveless Air Hammer Drills**

Stopers use solid steel. Sinkers and Drifters hollow steel and clean the holes with a blast of compressed air. Down holes, wet or dry, can be cleaned perfectly to a depth of 8 feet.

We do not claim that our machines will drill *faster* than any others. Many rock drills will drill very fast, but it is difficult to make a machine that will stand up day after day and month after month without coming on top for repairs; and this is what we claim for our machines. Repairs on them, year in and year out, will not amount to more than $24.00 per year. We make guarantee on cost of up-keep and economy in air.

With any of them, one man can drill 90 ft. in hard rock and blast in one eight-hour shift.

Although we make special machines for Stoping, Drifting and Sinking, we also make a machine that can be used for Stoping with Solid Steel or Drifting and Sinking with Hollow Steel.

Send for latest bulletins.

C. T. Carnahan Mfg. Co., Denver, Colo., U. S. A.

You Cannot Break a B & C Valve

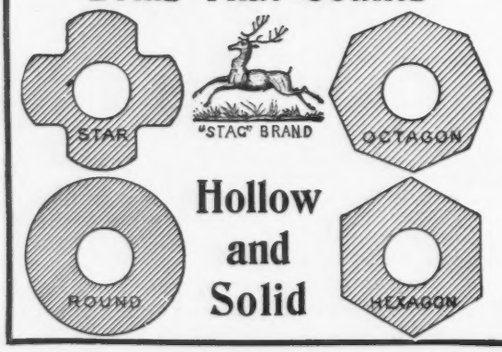
B & C Lubricator-Valves are now made in Malleable iron and are unbreakable. They have always been far stronger than a common stop cock because of the protection given by the outer casing containing the oil. Now that they are made of malleable iron, you cannot break them with a sledge hammer.

Still sent on trial to responsible companies.

Ask for our new catalog No. 4, which describes this valve and three others that you need.

Western Lubricating Valve Co, 1416-1418 Wazee St., Denver, Colo.

It's The Steel In The Drills That Counts



Hollow and Solid

It's the *quality of steel* used in the *drills* that often determines the success of a rock drill sent out by a manufacturer for test. Many times it's not the machine nor the way the drills are made that loses the order. It's something back of all this—*the steel.*

Mere *quality* may come high; but many manufacturers of rock drills and *users* of drills lose sight of what goes *with* quality—long life, greater efficiency and *ultimate economy.* And so, the use of **Allen's Stag Brand Steel** for Mining Drills brings about the greatest satisfaction and economy at a slightly higher cost. Allen's "Stag Brand" is a superior grade; carried in stock in all sizes and sections. Won't you try it?

Sole Makers: Edgar Allen & Co., Limited,

J. C. Ward, Director and General Manager,

434 W. Randolph St., Chicago, Ill.

Colorado Agents: The Hampson-Fielding Engineering Co., Denver, Colo.

STEAM, OIL, GAS,

climatic changes and other influences that shorten the life of rubber hose do not affect AMERICAN METAL HOSE.

American Metal Hose contains no rubber although it is just as *flexible* as rubber hose and much more *durable.* You will find it decidedly worth while to take advantage of our

FREE DEMONSTRATION OFFERS:

OFFER 7.—If you wish to examine its construction, we will send you a short section of AMERICAN METAL HOSE *free* on request.

OFFER 8.—If you wish to know what AMERICAN METAL HOSE will *do*, we will send enough to enable you to give it a practical test. *You incur no obligation unless the hose makes good.*

In taking advantage of either offer, please *specify what the hose is to be used for, size of hose and connections required.*

→ Price and Size List "D" on Request. AMETALHOSE We make the Interlocking Profile. ←

THE AMERICAN METAL HOSE COMPANY

Works: Waterbury, Conn. 173-177 Lafayette St., New York

TERRY CORE DRILL COMPANY

50 Church St., New York.

HAND AND POWER

CORE DRILLS

For Prospecting and Testing. All Sizes for All Depths of Holes.

SEND FOR CATALOGUE.

The Deitz Airolectric Rock Drill

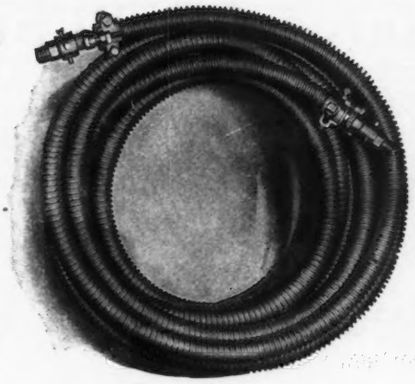
Installation one-third the cost of the old style rock drill plant.
Will break as much rock for half the money.
Will operate with one-tenth the power.
These claims are made under Absolute Guarantee.

Send for Catalog.

The Economic Machinery Company,

202 Exchange Building, Denver, Colo., U. S. A.

Air-Drill Hose
Pneumatic Tool Hose
Steam Hose
Water Hose



Power Hose
Pneumatic Transmission In Shops
Couplings For Hose
Splicing Clamps Fittings

Sprague Flexible Steel Armored Hose

Reduces Maintenance Expense

No Kinking — No Chafing — No Bursting

No danger of sudden breaks in the hose, causing expense, delays or serious liabilities from injury to workmen.

These advantages are obtained only in the Sprague Flexible Steel Armored Hose. They are due to the type of construction: the best grade rubber hose with an interlocking flexible steel armor.

If you want to learn of a real economy send for our bulletin No. 51632—it tells.

Sprague Electric Company

General Offices

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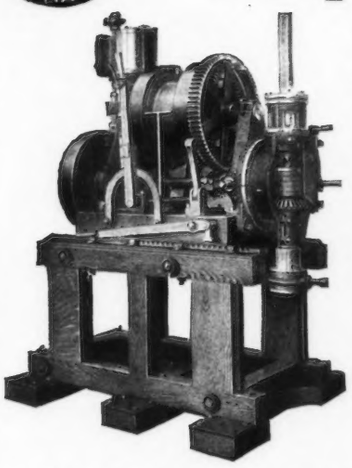
MARQUETTE MMM MINING MACHINERY

Especially Adapted For Churn Drilling And Driving



Type "S" Drill 800 feet Capacity.

¶ It will be to your interest to thoroughly study the features of our Diamond Core Drilling Machines. They are drills of the most modern and successful type. We build them up to 3500 ft. capacity. We also make Diamond Drill Supply parts. *Write for Bulletins containing complete information.*

Lake Shore Engine Works

Marquette, Mich.

Agents: H. C. Richmond Machinery Co., Salt Lake City, Utah. Western Mining Supply Co., Butte, Mont.

Pneumelectric TRADE MARK.

The Combination of Air and Electricity

is what has led to the **immense success of the**

PNEUMELECTRIC COAL PUNCHER

For this coal mining machine undercuts a wedge-shaped kerf which permits the coal to fall readily with a minimum amount of powder. It produces the best grade of coal, and is successful where timbers must be set close to the face of the coal. Its

Economy is remarkable

Power is transmitted electrically, hence with little loss, and the air is compressed and utilized at the face of the coal before losses of heat or pressure can occur.

The PNEUMELECTRIC Machine Company

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Is A SWEDISH Charcoal Drill Steel

OF THE HIGHEST QUALITY

MADE ESPECIALLY FOR HARD SERVICE IN HAMMER MACHINE DRILLING

HOLLOW and SOLID

SOLD EITHER IN THE BAR OR MADE UP READY FOR USE BY THE SOLE IMPORTERS

International High Speed Steel Co.

NEW YORK CITY

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JACKSON
Hand Power Rock Drills

Will do Double the Drilling Without Increasing Labor

Easier to operate than to drill with a hammer. Guaranteed to drill the hardest rock and against breaking for two years. Gold Medal at A.Y.P. Exposition.

Over 2,000 Sold

Write for Catalog C-19 and address of agent, where drill may be seen.

The Mining Supply Co.

66 Broad St., New York.

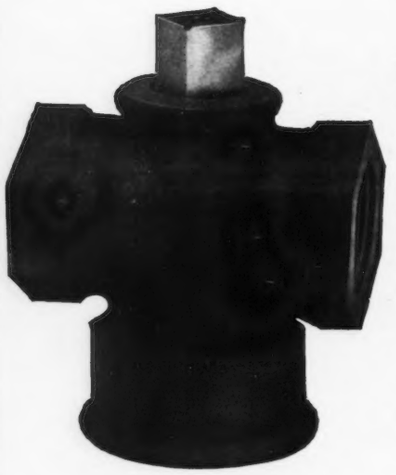
Ask for price on Swedish Drill Steel.

Whitcomb Stop Cocks

USED by all the principal copper mining companies in Northern Michigan, Whitcomb Air Valves are particularly effective for Compressed Air Lines and Cyanide plants.

They are all carefully ground and tested before leaving our shop.

Their construction is radically different from the ordinary stop cock. That is why they give better service.



Write today for Circular and Prices.

Geo. D. Whitcomb Co.

Rochelle, Ill.

Case Melting Furnace

When you are in the market for furnaces, we would be glad to have you figure with us, as we believe we have the best line of furnaces made.

We Manufacture, Export and Import Assayers' and Chemists' Supplies.

Catalogue No. 20 gives full details.

The Denver Fire Clay Company

DENVER, COLO., and SALT LAKE CITY, UTAH, U. S. A.

Unequalled In Finish And Durability

Imported Chemical Stoneware

Imported direct from Germany by me, this stoneware is best for use with Hydrochloric Acid and Nitric Acid. I can furnish apparatus of this ware of all descriptions. Orders can be filled very promptly.

I also furnish: **Vacuum Pumps,** with improved system for pressure equalization.
Enameled Cast-Iron Apparatus that is thoroughly tested to be acid-proof and resists high temperatures.
Nitrating Centrifugals for explosive and chemical works.
Hard Porcelain Ball Mills.
High-Grade Chemical Porcelain Ware.

Write for further information.

J. W. Sittig, 5 Beekman Street, New York

Capacity

1/8"

to

4"

Our pride grows every time we look at this sturdy, 10 lb. chap!

We guarantee it unbreakable in service! We know its capacity means that you are worth just that much more to yourselves. There are none like it!

We know how handy, to have a tool just as effective on fittings as pipe and on post as bench.

You don't require a truck to carry this tool to the end of or away from the shop---it's a hand-bag "handful" of quick action, sure grip and life-time service.

Get acquainted. You'll warm up over it too! Every part wrought and guaranteed.

A Postal brings free Catalogue.

J. H. Williams & Co.
Superior Drop-forgings
Pioneers in Chain Pipe Tools
73 Richards St., Brooklyn, New York

"Vulcan" Vise

Repairing The Split Pipe Wherever It Is

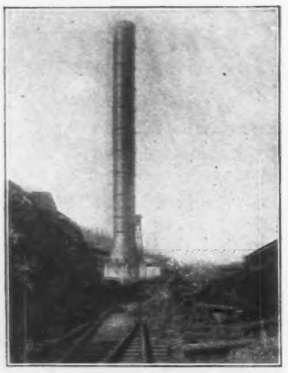
THE REASONS WHY so many mine managers are installing Toledo Pipe Threading Tools are many. But, perhaps, the chief one—the one that would appeal to any mine manager the most, is this:

You can take the Toledo anywhere and one man can do the work wherever it is—cut off the pipe, put on a "Toledo," cut a new thread, couple up a new short piece and the trouble's ended. This applies to any size pipe from 1/8" to 12".

Just figure what this *convenience* will mean to you—the time, labor and money it will save.

We have a Catalog for you—Write.

The Toledo Pipe Threading Machine Company
Toledo, Ohio



Self-Supporting Steel Stack, 18 feet Diameter, 200 feet High. Mammouth Copper Mining Company, Kennett, Calif.

Minneapolis Steel & Machinery Co.
Minneapolis, Minn.

We make a specialty of designing and erecting

Steel Construction

For Mines, Mills, Smelters, Shops, etc.

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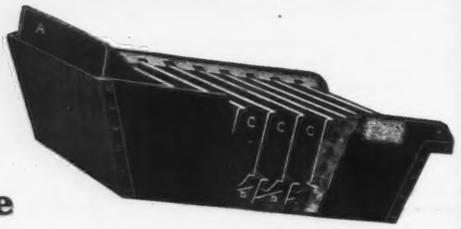
Butte: 352 Phoenix Bldg.

Let us have your inquiries for estimates on anything you may need in this line.

The Flour Gold Can't Escape



That is what makes the **Pierce Amalgamator** a paying proposition. One mill writes that it saved them $66,696 in eleven months.

Write today for Catalog F.

L. S. Pierce, Denver, Colo., U. S. A.

THE IMPROVED

New Standard Concentrator

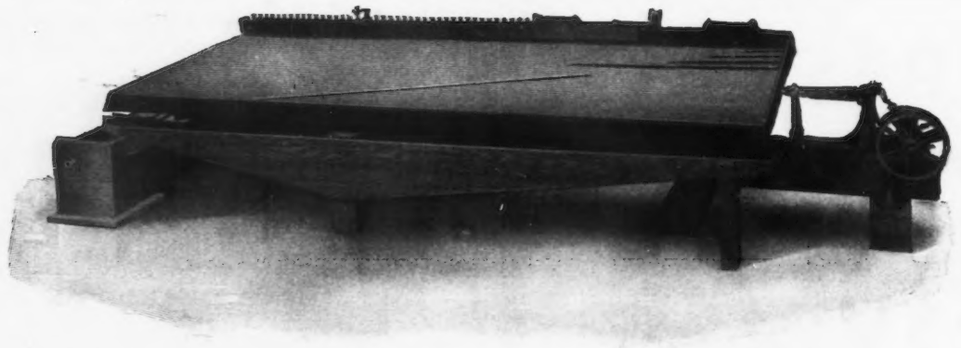
Larger capacity
More Tonnage
Cleaner Concentrates

PRICE $350.00

Costs Less
Closer Saving
Economical Repairs

Sole Manufacturers

LLEWELLYN IRON WORKS,
Mining Machinery of Every Description
Los Angeles, California.



The Dunham Concentrating Table

Has a 30%—or more—greater capacity than any other table
Requires less power and makes closer savings

We'll Prove It →

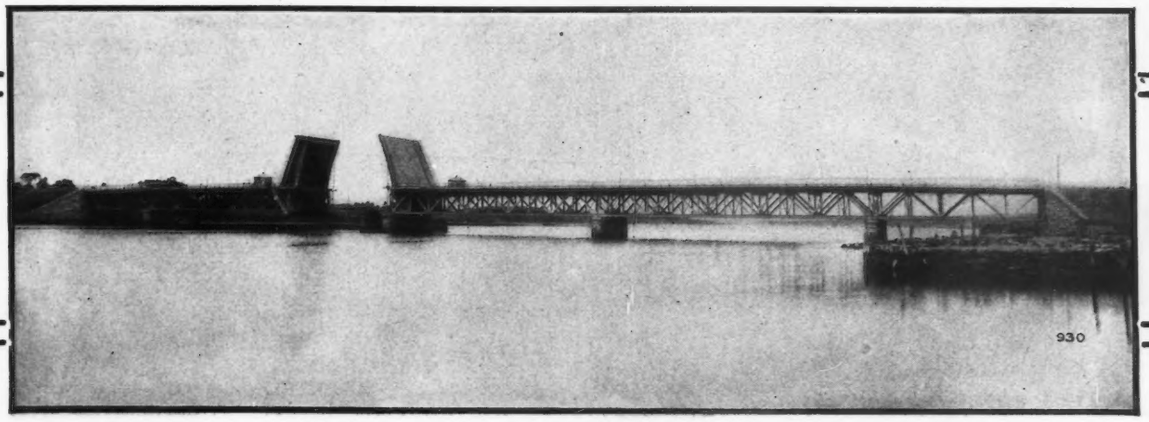
1. By submitting to you reports of comparative tests.
2. By telling you just what the Dunham can do on *your* ore—you to submit samples.
3. By explaining the features of the Dunham, making these results possible.

Give us the chance to "show" you. Write.

The Braeckel Concentrator Company, Joplin, Mo., U. S. A.

American Bridge Company of New York

Export Representatives, United States Steel Products Export Company, New York



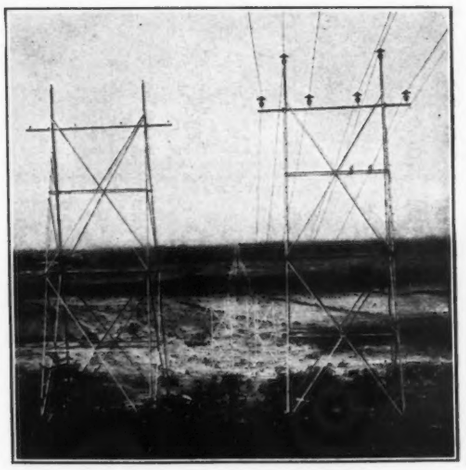
Taunton Great River Highway Bridge at Taunton, Mass.

Structural Steel For Every Purpose

Annual Capacity 750,000 Tons

General Offices: Hudson Terminal, 30 Church Street, New York

Contracting Offices In Twenty-two American Cities



Galvanized Transmission Towers.

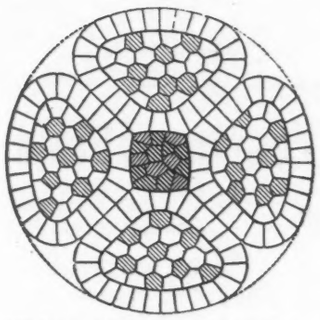
Riter-Conley Mfg. Company

PITTSBURG

Plate and Structural Work of Every Description

Complete Plants

Proper Lubrication



1¼" "American" Transmission Rope
Showing Lubricated and Covered Yarns

is just as necessary to a transmission rope as to any other working part of your equipment.

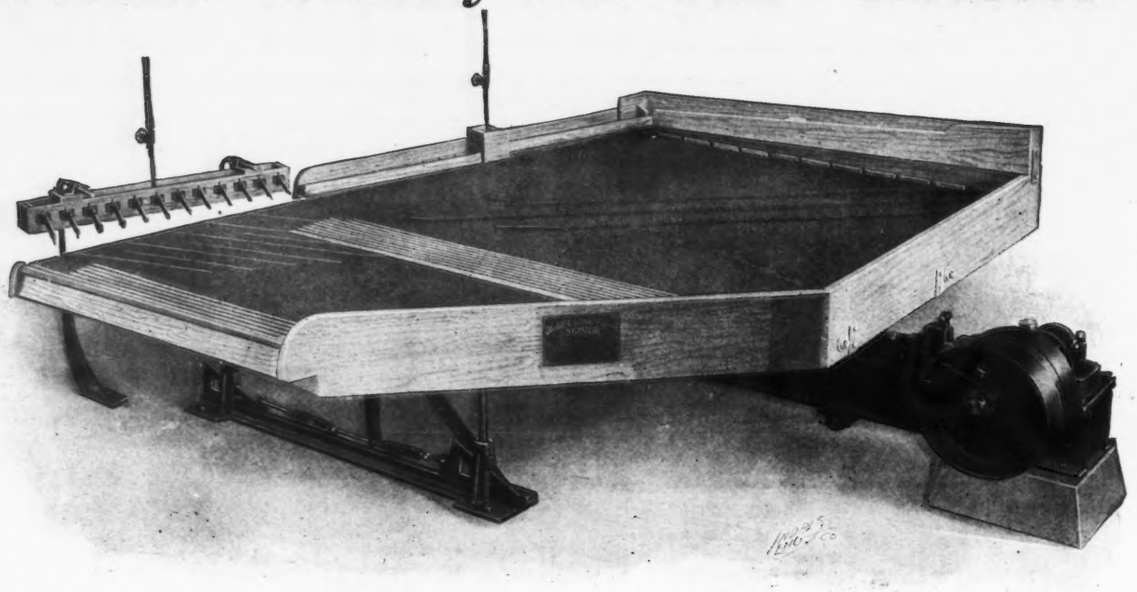
American Transmission Rope is internally lubricated as long as it lasts. Write for samples, prices and

"THE BOOK OF ROPE TRANSMISSION"

The American Mfg. Co.

65 Wall Street, New York

Another Victory For The "Deister"



We are placing 180 Improved No. 3 Deister Slime Tables and 132 No. 2 Deister Sand Tables in the Miami Copper Company's mill, Miami, Arizona. This large order was the direct result of the showing made by the Deister Tables. The No. 2 Deister competing against all of the well-known makes of tables on the market—the Improved No. 3 Deister competing against vanners

By eliminating teeth in the roller and rocker arm, our driving mechanism is now the most effective, noiseless and durable on the market.

The Deister Concentrator Co., Ft. Wayne, Indiana, U. S. A.

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THE·ART·IN·ITS·BROADEST·SENSE

HEMATITE · MAGNETITE · BROWN IRON ORE · BRASS CINDER · PYRITES · LEAD · ZINC · COPPER · GARNET · ANTHRACITE · BITUMINOUS COAL · PHOSPHATE GRAVEL · RECLAIMED RUBBER

WATER-MAGNETIC

20·YEARS·EXPERIENCE

Our Testing Plant with 20 years' experience Always At Your Service

Coal	We can determine the ultimate extent to which ash and sulphur can be removed. Coking propositions our specialty. We can then furnish a washery to do the work.
Iron Ores	We can determine the ultimate extent to which the insoluble can be removed, by jigging or magnetic separation, or by a combination of both processes, and we can furnish you a plant that will meet requirements in every particular.
Sulphide Ores	Copper, Lead, Zinc and Iron, in all their forms and complex associations, treated by wet or magnetic concentration, or a combination of both processes. Your proposition reduced to a commercial basis if it has one. If you like the showing, leave the design and equipment of the plant to us.
Any Substance	not soluble in water, mixed up with something—else you wish to separate them—let us try it. We have solved many such problems.

This Is Our Business. We Understand It.

THE PREPARATION OF IRON ORES AND COAL

AMERICAN CONCENTRATOR CO.,

NEW CENTURY

INC. 1900

PHILADELPHIA—WEIGHTMAN BLD'G

JOPLIN, MO., U.S.A.

BIRMINGHAM—BROWN-MARX BLD'G

CRUSHING SCREENING CONCENTRATING AND MAGNETIC SEPARATING MACHINERY

DODGE

Belt Conveyor Economy And How The Dodge Idea Insures It

A BELT CONVEYOR which is to convey certain materials—and convey them economically—is an engineering proposition involving considerably more than a few pulleys and a length of belting.

EVERY BELT CONVEYOR ought to be designed to meet the specific conditions under which it must work.

THAT'S THE DODGE IDEA as applied to belt conveyors, and developed during many years' experience in furnishing them for the most exacting service in mines and mills.

AND THAT IS WHY we maintain a corps of engineers, experts in this class of work, for the solution of conveying and elevating problems.

THESE ENGINEERS WILL go over your specifications and data, and prepare plans of a conveyor to exactly meet the conditions at your plant and convey your materials at lowest cost.

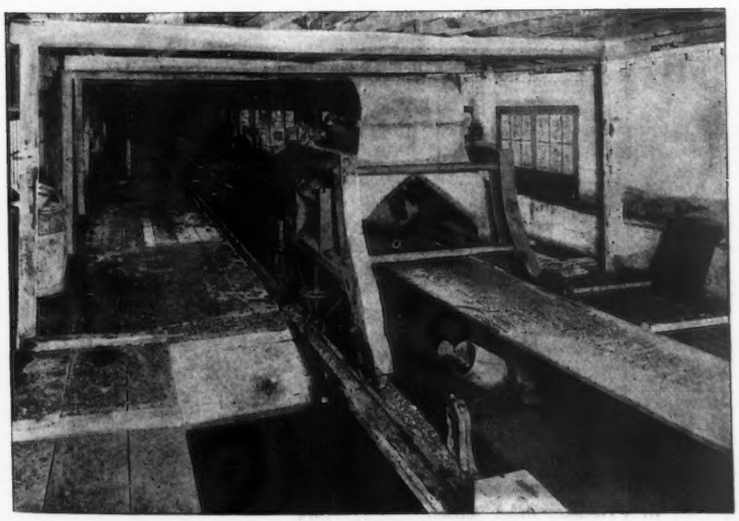
THE PLANS WE SUBMIT will reflect our whole experience in this branch of engineering, and if we furnish the conveyor for you we will fully warrant its successful operation.

MANY OF THE LARGEST mining and smelting companies in the United States, Mexico and South America, use Dodge Conveyors—because they give the best service at least expense of operation and maintenance. And they would accomplish that for you.

WE WANT TO PLACE our engineering experience and service at your command, in connection with any conveyor or elevator installations you contemplate making.

SEND US YOUR SKETCHES and data, let us submit plans and estimates on your requirements, and information about conveying and elevating that should be of value to you.

ANYWAY WRITE US to send you some interesting printed matter we have on this subject—series W.



A Dodge Belt Conveyor designed to carry coal. With Automatic Tripper.

Dodge Mfg. Company,

Sta. F-17, Mishawaka, Ind.

"Everything for the Mechanical Transmission of Power," Elevating and Conveying Equipment and the "Eureka" Water Softener and Purifier.

Agencies and Branch Houses in All Principal Cities.

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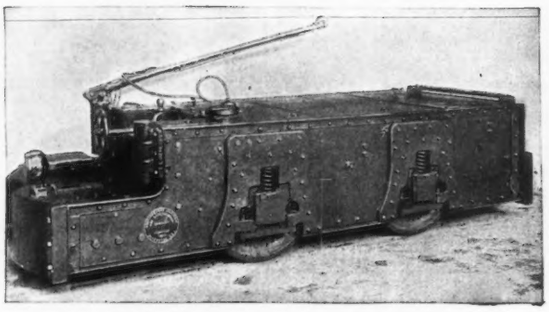

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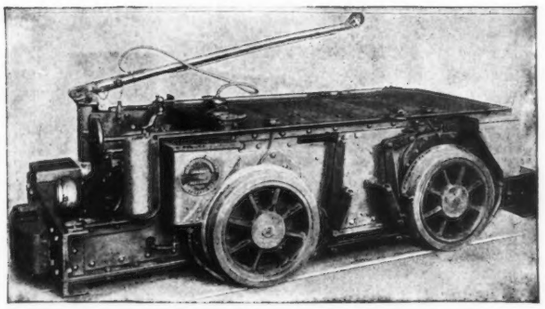

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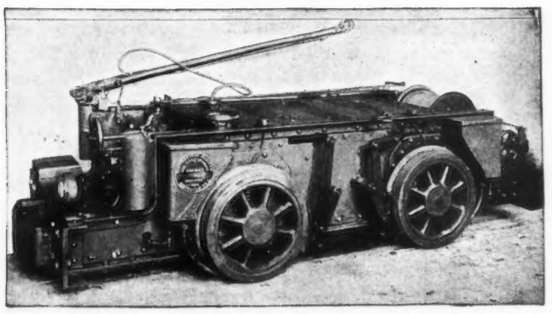

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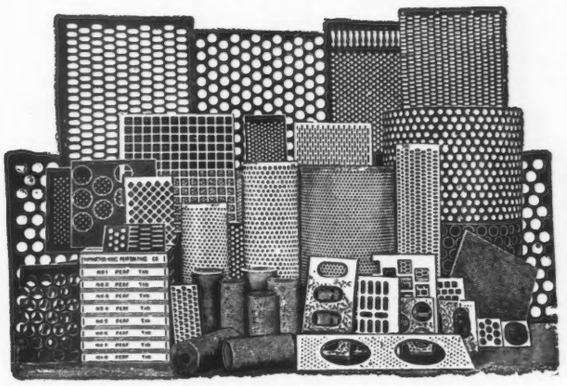

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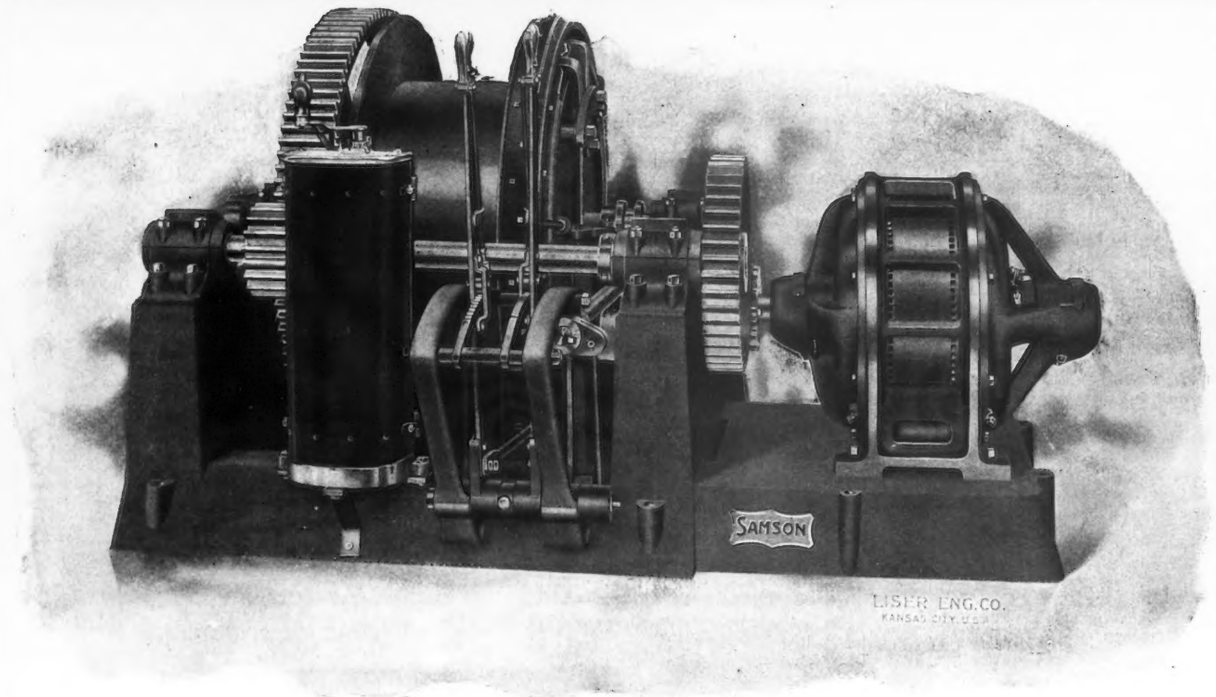

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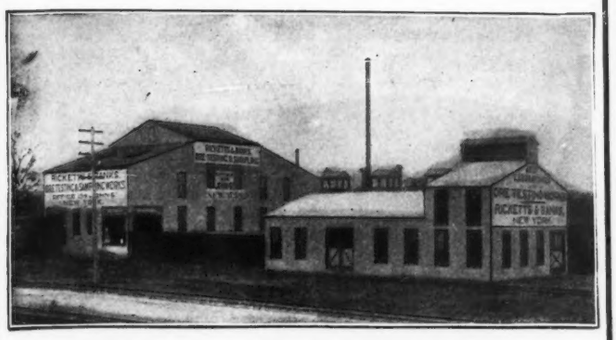

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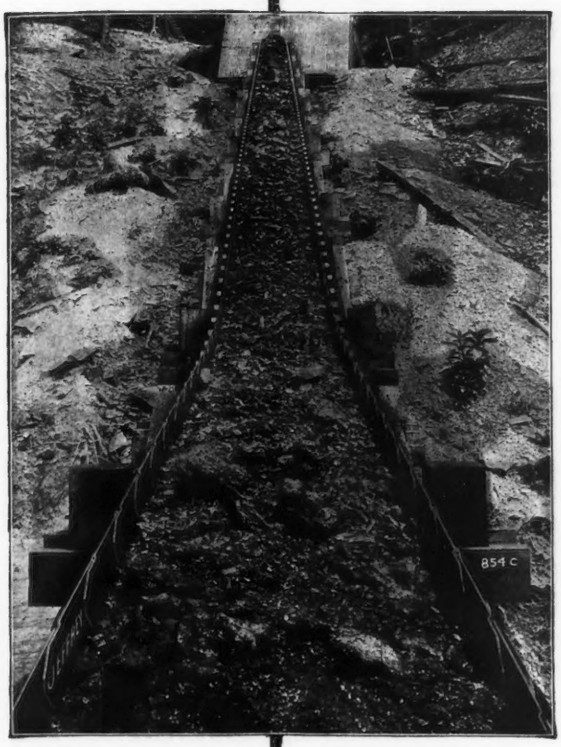

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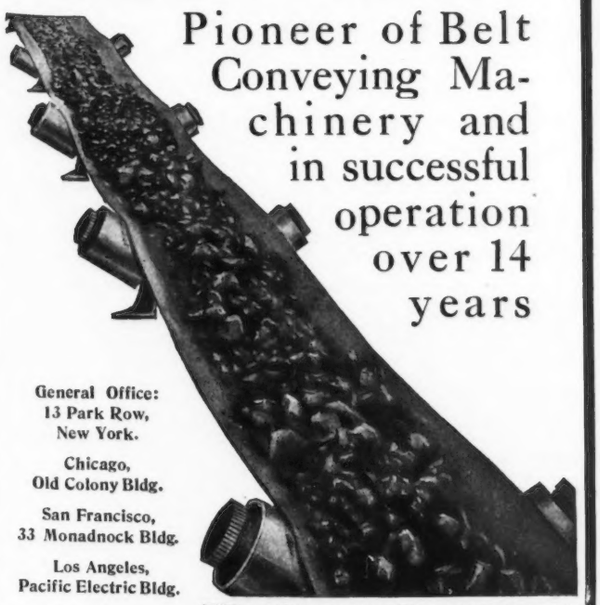

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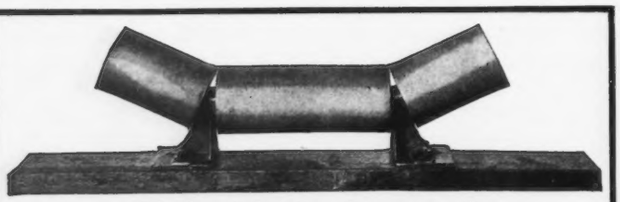

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Besides making a building cooler in summer and warmer in winter, it is the only smooth-surfaced ready roofing that never needs painting. J-M Asbestos is also the only ready roofing that is fire-proof.

Its first cost is the only cost.

Our nearest office will gladly send samples and particulars. Write for them today—or simply write your name and address on margin of this advertisement and mail it to us.

Made in Flat Sheets and in Rolls

People's Ice & Fuel Company

PHOENIX, ARIZONA July 25, 1906.

H. W. Johns-Manville Co.,
203 E. 5th St.,
Los Angeles, Cal.

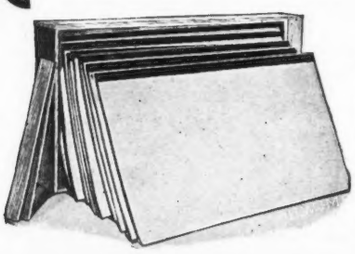
Gentlemen:-

Replying to your favor of the 21st inst. in regard to the J-M Asbestos Roofing, which we have on our Plant here, beg to state that during the extreme hot weather here, when the temperature reaches 116 degrees to 118 degrees, the temperature in our building is not over 98 degrees to 100 degrees, and we owe this to the excellent heat resisting qualities of your Roofing. I have been in other buildings here, that were covered with gravel, galvanized iron, etc., and there was but a few degrees difference between the temperature inside of the building and outside.

As to its water proof qualities, would state that there has been hot water blown off the Steam Condensor Coils continuously and I fail to see where it has effected the Roofing in any manner whatever.

Very truly yours,
Peoples Ice & Fuel Company.

per M. H. B. Singer



H. W. JOHNS-MANVILLE CO.

Manufacturers of Asbestos and Magnesia Products, ASBESTOS Asbestos Roofings, Packings, Electrical Supplies, Etc.

Baltimore, Boston, Buffalo, Chicago, Cleveland, Dallas, Detroit, Kansas City, London, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburg, San Francisco, Seattle, St. Louis

For Canada:—THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED.
Toronto, Ont. Montreal, Que. Winnipeg, Man. Vancouver, B. C.

"The Roof For Any Building Anywhere." 1212

TROJAN POWDER
THE SUCCESSOR TO NITROGLYCERIN DYNAMITE

has no liquid base and cannot freeze; will not explode from impact or jar, generates no injurious gases from combustion, produces no flame and stick for stick does the work of Nitro-glycerin Dynamite at a lower cost.

Investigation Courted.

Trojan Powder Company

(INDEPENDENT)

New York, 65 Pine Street.
Denver, Symes Building.
Allentown, Pa., Nat. Bank Bldg.
San Francisco, Phelan Building.
Salt Lake City, Dooly Block.
Portland, Ore., Henry Bldg.

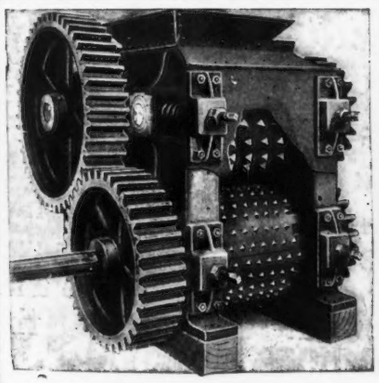
A PATENT valve control regulates the water feed to the carbide chamber in the "Scranton" Acetylene Mine Lamp. It enables positive regulation of the flame.

That's Why The Flame Lasts Longer Without Recharging

The "Scranton" Lamp is simple and durable. It is safe and exceedingly easy to operate. Let us send you a Circular describing it, also prices.

Write today.

Francis H. Coffin & Co.
Board of Trade Scranton, Pa.
General Sales Agents



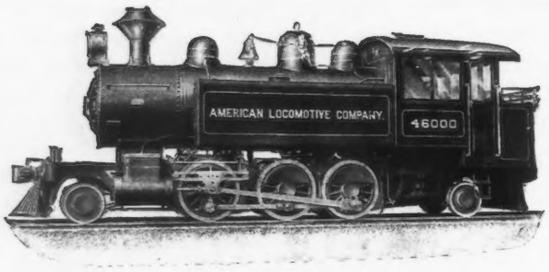
ORE AND COAL CRUSHERS,
10 TO 300 TONS PER HOUR.

C. O. BARTLETT AND SNOW CO.

MAKERS OF CLEVELAND, O. U.S.A.

PICKING TABLES

ELEVATORS AND CONVEYORS.



Locomotives

Coal or wood burning
For switching around mines and smelters
Simple Designs
Large Boilers
Free Steaming
Low Fuel Consumption
Minimum Breakdowns
Moderate Repair Costs

Railway Exchange, Chicago

American Locomotive Company

30 Church Street, New York

N. B. LIVERMORE & COMPANY, AGENTS.

Salt Lake City San Francisco Seattle

LOCOMOTIVES

4 to 60 Tons.

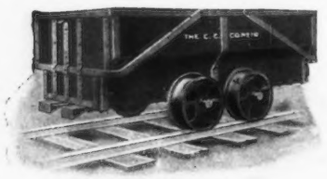
Steam or Compressed Air. Narrow and Wide Gages.

We have 36 and 56½-inch gage locomotives for immediate or quick delivery.

NEW STYLE "CONTRACTORS."
Tenth edition catalog just printed, mailed free to mine, railway or industrial officials.

H. K. PORTER COMPANY,
410 Wood Street, PITTSBURG, PENNA.
New York Office, Hudson Terminal Bldg., 30 Church St.

Cleveland Cars On Liberal Trial



Any responsible concern can have ample opportunity to test the value of any of our cars right on his own work, without risk. Every car we make is fully guaranteed, and our cars will handle more material, at less expense and with fewer repairs than any other cars of their sizes now manufactured.

Write for catalog.

The Cleveland Car Company,
West Park, Ohio.

"K & J" CARS

ARE BUILT FOR "CONTINUOUS SERVICE"

Type No. 598—"Hopper Car"

When You Have A Hand In A Job

yourself you're pretty confident it's going to be right, aren't you?

The "K & J" System of building combines your thorough knowledge with ours. *"Some Car Suggestions" tells how.*

The Kilbourne & Jacobs Mfg. Co.
Columbus, Ohio

364

Specially Designed Mine Cars

Our business is to supply you with the car that exactly meets your requirements. It means economy for you. It means a car that will last longer because it is built for that special service.

Our catalog is full of information regarding mine and ore cars and all kinds of equipment for the railway. Let us send you a copy.

It will interest you.

Wonham-Magor Car Works,
50 Church St., New York

STEEL CARS

Our capacity is unlimited If the car illustrated does not show the type you use, why form the opinion that we do not make it?—we do.

The workmanship and material will be the very best.

Prompt deliveries of Rails, Frogs, Switches, Crossings, Turntables, Wheels, Cars, etc. Let us send specifications and prices.

Catalog 15 sent on request.

Agents for Industrial Locomotives of the Baldwin Locomotive Works.

RAILROAD SPECIALISTS FOR ALL INDUSTRIES.
ERNST WIENER COMPANY
200 Fulton Street, New York, N. Y.

Branch Offices: Pittsburg, Chicago, St. Louis, San Francisco, Los Angeles, Denver, Boston, Montreal.

Cars for every purpose known to the business of mining

First Class Material Careful design by competent Carmen. A Well equipped Shop.

Intelligent American mechanics who have been with us a life time

The Watt Mining Car Wheel Co.
Barnesville, Ohio., U. S. A.

Moments with the Advertising Manager

A Department for Subscribers Edited by the Advertising Service Department of The Engineering and Mining Journal

The man who has invented a new machine will gladly spend a whole evening telling you all its wonderful points.

The fellow who has a new drill or a new pump—or a new baby—will talk your arm off about it if you don't flag him.

But supposing he had to pay say $100 a page to talk to you, wouldn't he be tongue-tied?

You know the answer.

If he had to come across with real, "pay-to-the-order-of" money, he wouldn't shout until the new machine or article had been *tried* and *tested* and *proved* valuable *by experts*.

Then, after he really *knew* that his claims were true, he'd hire some space and tell you his little story.

Which, Mr. Reader, constitutes Reason No. 19 why *advertised goods* are safest.

* * * *

Substitution is an evil encountered by many advertisers—especially those whose goods have been for years on the market.

The "substitutor" is a mean cuss.

Avoid him.

He is trading on the other fellow's reputation which has been years in the making.

He is a confidence man of the first water.

And the fellow he fools with his "just-as-good," or his palpable imitation of the real thing—that man is the goat.

Be sure you get what you ask for—

Or walk out!

* * * *

Every reader should remember that it "pays to advertise" only because *it pays to buy advertised goods*.

The rule of advertising works both ways, but it *must* work for the reader *first*.

* * * *

Advertising is a salesman. It covers more territory at far less cost than human salesmen can. It reduces the cost of marketing an article tremendously.

If it wasn't for the power of advertising, most of the things you buy would cost a whole lot more.

Bear this in mind when you read your paper.

* * * *

If P. T. Barnum hadn't lived when advertising was *in its infancy*, he would never have died a millionaire.

You can't even fool *some* of the people *some* of the time nowadays.

* * * *

And speaking of "circus advertising"—what a change time has wrought in the publicity business!

You laugh at the old-fashioned, exaggerated, superlative adjective style today—it has no effect on you at all.

Why? Simply because advertising has become a sane, practical, scientific means of promoting business.

And the few manufacturers who cling to the old circus style get more laughs than business these days.

You can see it's you, the readers and buyers, who have made advertising scientific and sane.

Because you won't read unless the ad appeals to your reason, and you won't buy until you are convinced that the ad is true and the article is good.

And as a result what do you get?

Page after page of interesting, valuable, convincing information—ads full of meat, full of truth, full of reason.

And naturally you read those pages for your education and profit.

Verily, advertising has changed since the days of Barnum—and now *you* have "the greatest show on earth" of getting exactly what you want from the advertisements.

THE MOST IMPORTANT MINING BOOK OF MANY YEARS

THE first important treatise on mining costs. The factors entering into these and their proper determination are of prime importance to every mining engineer, stockholder and mine manager. Heretofore there have been only the most meagre data from such mines as have published satisfactory reports. Mr. Finlay's book covers coal, iron, lead, zinc, copper, gold and silver. It concentrates its attention upon an exbihition of the facts in their proper proportion and bases all results upon a large percentage of the existing mines. In this way it covers all conditions. Mr. Finlay had at his disposal an unusual amount of heretofore unpublished material, and is able to give results that have hitherto been unattainable.

COST *of* MINING

By J. R. FINLAY, E. M., Secretary of the Mining and Metallurgical Society of America.

416 Pages, 6x9 Illustrated, $5.00 (21 s) Net, Postpaid.

It is not a book on methods, but an economic study of those principles which must be followed in every successful mining venture. These principles are admirably covered because typical results, obtained primarily in America, but from other sections of the world as well, are brought into the reckoning. Finally, it is not so much for the specific data and figures given that the book is valuable, as for the analyses and deductions which Mr. Finlay sets forth with admirable clearness.

CONTENTS:

I Value of Mining Property.
II Factors Governing Variations.
III Partial and Complete Costs.
IV Statistics of Coal Production.
V Cost of Mining Coal.
VI Cost of Mining Lake Superior Iron.
VII Occurrence and Production of Copper.
VIII Lake Superior Amygdaloid Copper Mines.
IX Conglomerate Copper Mines of Lake Superior.
X Copper Mines on Fissure Veins in Montana, Australia and Arizona.
XI Various Copper Mines of Arizona and Mexico.
XII Copper Mines in Various Other Districts.
XIII The Copper Mining Business in General.
XIV Lead.
XV Silver-Lead Mining.
XVI The Cost of Silver-Lead Smelting.
XVII Zinc Mining.
XVIII Occurrence and Production of Gold.
XIX Quartz-Pyrite Gold Mines.
XX Cripple Creek, Kalgoorlie and Goldfield.
XXI Silver Mining at Cobalt and Guanajuato.

McGRAW-HILL BOOK CO.

239 WEST 39TH ST., NEW YORK.

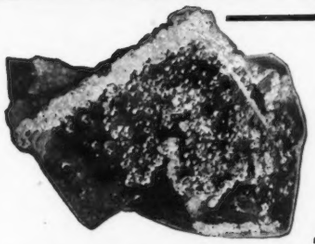
London Office, 6 Bouverie Street, E. C.
Berlin: Unter den Linden, 71

SOLD SUBJECT TO OUR GUARANTEE

PUBLISHERS OF BOOKS FOR THE ENGINEERING and MINING JOURNAL

C-W motors are subjected to severe overloads in our testing-pit. This is one reason why **C-W** motors do better than is expected of them. See Bulletin 118 P.

Crocker-Wheeler Company, Ampere, N. J.



Rare Minerals

Bought and Sold in Ton or Carload Lots. In offering, send small samples. Estab. 1876.

TITANIUM VANADIUM BERYLLIUM TANTALUM, ETC.

FOOTE Mineral Co., 107 N. 19th St., Philadelphia, Pa.

Rare Ores for M'f'rs. Samples for Experts.

FREE in 1910: *Complete Mineral and Rock Catalogs. 350 pp., 300 ill. Send 15c. postage. Foreign stamps accepted.*

INCORPORATE under Arizona Laws. No franchise or annual tax. Members exempt from all corporate debts. No public statements required. Capitalization does not affect cost. No stock subscription before organization required. Stock can be made non-assessable and paid up for cash, services or anything of value. Hold all meetings. keep books and transact business anywhere. Charters cannot be repealed by subsequent legislation. Cost for incorporation *very small.* We furnish by-laws and all instruments with Corporate Management and Record free. Write for free 40-page "Book of Information" on Arizona Corporation Laws, blanks, etc. Southwestern Securities & Investment Company, Box M488, Phœnix, Arizona.

IN the selling section of this paper are advertisements of the *representative* concerns catering to the mining industry. Consult these pages.

Ridgway Units

have large overload capacity and are Sparkless at all loads, with fixed brushes.

Ask for Bulletins 19, 20, 21 and 24-E.

Ridgway Dynamo & Engine Co.
Ridgway, Pa.

ARE you turning your space into real advertising?

Are you getting the right kind of copy into it and the right kind of results out of it?

Our Service Department is here to help you get all that's possible out of your space.

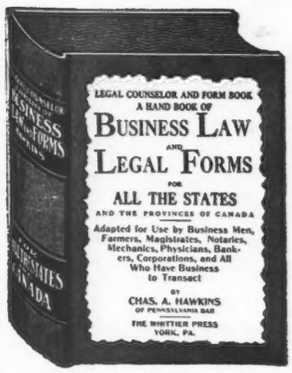
It is ready to go deep into the selling proposition of any manufacturer who wants mining business.

Service Department

The Engineering and Mining Journal
New York

A GREAT QUESTION ANSWERER

Thousands of Law Points Over 600 Legal Forms



Of Practical Money Saving, Trouble Saving Value.

The very essence of the law set forth under more than 550 topics, arranged alphabetically and covering the whole field. A condensed Encyclopedia of Law. The law "boiled down," simply told, easily found. Drawn from the highest authorities, safe, clear, brief, practical, economical, always ready, a good investment. It will help you to avoid mistakes. It is an aid to business, a saver of law suits.

"The combined achievement of 151 lawyers in the U. S. and Canada.

It Contains { *Law* you are constantly wanting to know. *Forms* you have frequent occasion to use. }

It Furnishes { *Answers* to thousands of legal questions. *Information* you need *when* you need it. }

Includes { Not only general *legal principles*, but also summaries of important U. S., State and Canadian *statute* laws. }

Get a copy and examine for yourself. (See below.) You need this book at your elbow to find points of law about real estate, fertilizers, partners, sales, patents, fences, cattle, churches, estates, marriages, liquors, or any of the *hundreds of subjects* treated, or to write a contract, will, lease, bill of sale, power of attorney, deed for mine, or whatever it may be. Over 1250 large double columns, equal to 1000 large octavo pages.

A Few of the Comments by Lawyers.

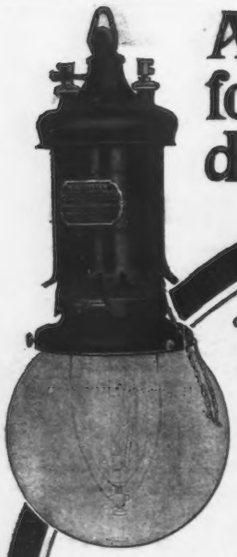
"Very comprehensive, complete and thorough."—*C. E. Castle, Wagoner, Okla.*
"The forms are up-to-date and practical."—*L. D. Bailey, Bangor, Me.*
"A quick, effectual and reliable reference book."—*F. R. Chapman, Wellsburg, W. Va.*
"Takes a place among the best modern law publications."—*Frank Higgins, Victoria, B. C.*

PRICE: Bound in Basket Buckram..... $3.75.
Send $3.75 or cut out, sign and mail the following.

THE WHITTIER PRESS, YORK, PA. Mail me, for examination, Legal Counselor and Form Book. Within 10 days after receiving it I will remit $3.75, or write you for postage to remail it to you.

Name.....

E. M. Address.....



An Arc Lamp for Every Condition of Service

One type of lamp can't fill all conditions. The one that proves best for interior lighting may be altogether unsuited for outdoor or street illumination. If you are looking for a suitable lamp for lighting City streets or for use in a Mine, Factory, Warehouse or Yard, you want to investigate

Fort Wayne Arc Lamps

A distinct type of lamp for every use, and into each type is put a quarter of a century's experience and the best material and workmanship obtainable.

Can anyone offer you better assurance? And proof--look at our lamps in operation all over the country. Their service means more than all the guarantees ever written.

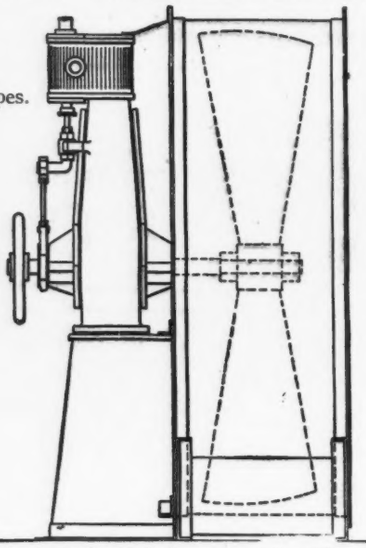
Fort Wayne Electric Works
1613 Broadway
Fort Wayne, Indiana
Branch Offices in Most Large Cities

A special illustrated Bulletin on each subject. Send today for the one you want.

Buffalo Mine Disc Fans

Pulley—Steam—Electric Drive

All sizes and types.



Catalog 197 N on request

Used extensively for assisting a furnace or fan outside and can be installed at any convenient place in the air course.

Buffalo Forge Company,
Engineers and Manufacturers
Buffalo, N.Y.

The Value Of Mine Records

Did you ever stop to consider carefully whether your records and accounts are of practical value?

Do they present the facts which you need for operating purposes?

Are the statements in such shape that they mean something to you?

When you wish to know the cost per ton of ore, or per ounce or per pound of product, per foot of development, etc., can you get the needed information promptly from the records?

Can you place confidence in the accuracy and value of what the records show?

Mine Records

and accounts can and should be so kept as to give the information of practical value clearly and concisely, unencumbered by a mass of useless figures. This is not a theoretical proposition but an actual possibility based on what has been and is being done in actual practice with mine records and accounts.

Perhaps we can help you in this matter.

Suffern & Son,
Certified Accountants
165 Broadway **New York**

Why Not Save All Of Your Fine Ore?

Don't let the fine ones get away simply because you can not pick them by hand. It won't cost a fortune to install a McLanahan Ore Jig and also a washer to prepare the ore for furnace or jig—you'll be money in pocket by so doing.

Let us show you the way to make money

McLanahan-Stone Machine Co.
Hollidaysburg, Pa., **U. S. A.**

Our Improved Automatic

Trough Washer

removes impurities from
Coal, Culm, Ores, Sands, Clinker, Metallic Sweepings, etc.

Excessive impurities and limited Water Supply no drawback. Large Output. Low Cost. Small Power required. **Simple, Durable, Efficient.** Easily and cheaply erected and operated anywhere.

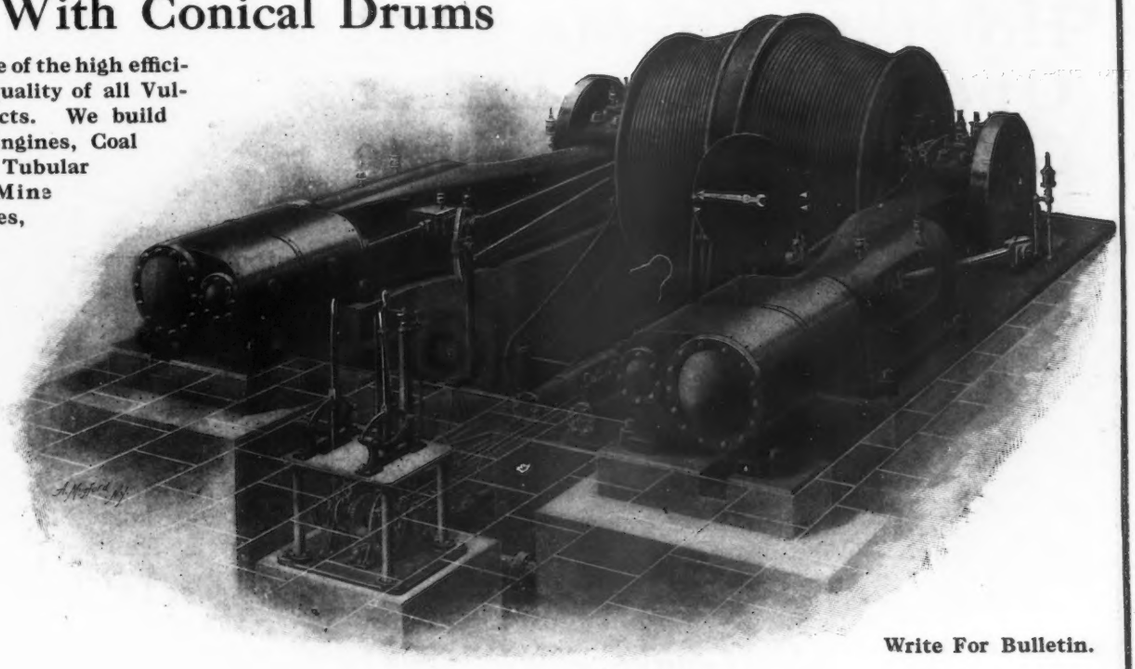
Send for descriptive circular to

Scaife Foundry & Machine Co., Ltd.
Pittsburgh, Penna.

The Vulcan Direct Acting Hoist

With Conical Drums

An example of the high efficiency and quality of all Vulcan products. We build Haulage Engines, Coal Crushers, Tubular Boilers, Mine Locomotives, etc.



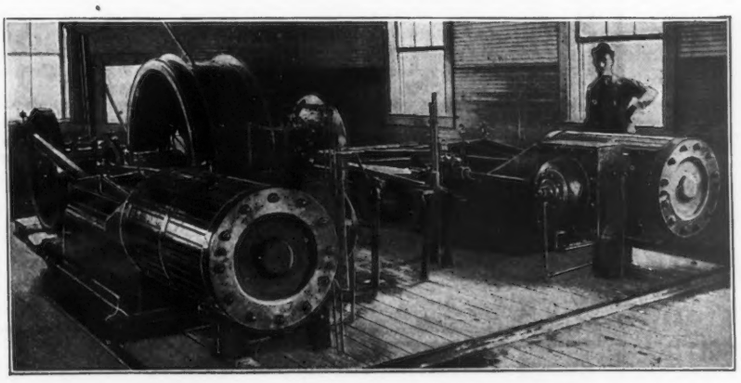
Write For Bulletin.

Vulcan Iron Works, Wilkes-Barre, Pa.

New York Office: 50 Church Street.

DANVILLE

439 Tons Of Coal Per Hour Is Hoisting Some



THAT'S just one of the records of the "Danville"—3,516 *tons of coal in* 8 *hours.*

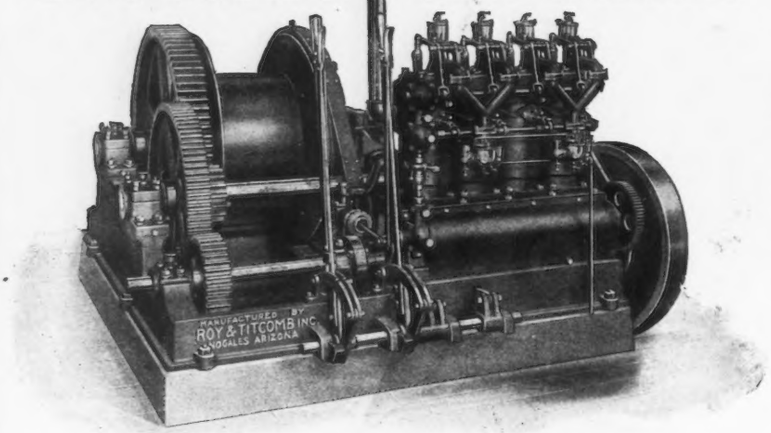
The "Danville" is built for rapid, continuous service. Every part is the result of study and experience. We have been building Danville Hoists for over 30 years. Write for particulars and we'll also refer you to the nearest "Danville" so that you yourself may see it working.

Danville Foundry and Machine Co.
Danville, Ill., U. S. A.

Pittsburg Representative, F. K. Potter, Keenan Bldg., Pittsburg, Pa.

HOISTING ENGINES

The Economy Of A Hoisting Engine That Operates On Either Gasoline or Distillate



Built either Single or Double Drum, 15, 22, 30, 50 and 70 H. P.
Also built sectional for muleback transportation up to 50 H. P.

OUR Gasoline Hoisting Engine has been operated successfully on No. 4 distillate.

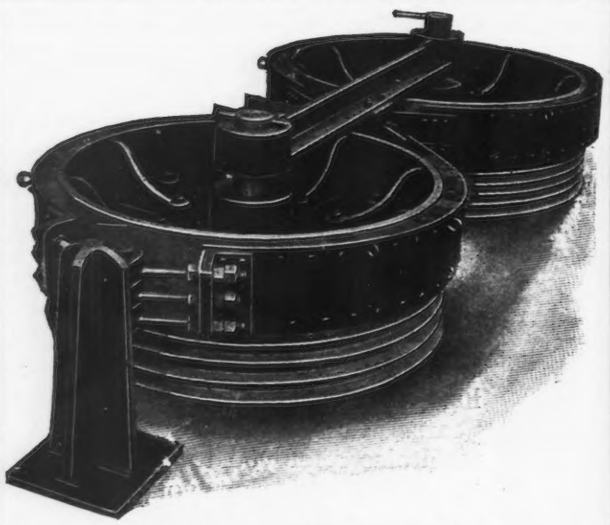
Then there's the economy of being able to stop the engine every trip, if desired.

It starts and handles like an automobile and the engineer has perfect control over it. The Brake and Clutch Levers and Regulating Device are all directly in front of him. The rope speed—70 *to* 400 *ft. per minute*—is just as he desires.

This hoist practically eliminates the danger of handling men over shots.

Write for full particulars. You'll find them interesting.

Roy & Titcomb, Inc., Nogales, Arizona



Tear Out The Drums

And Put In Our Gravity Plane

Others are doing it because they've found that this modern method of haulage is far ahead of old systems.
We hold records of 15-years-running-and-no-repair-bills.

Ask for Bulletin 60, *and get our estimates.*

S. B. Stine, Osceola Mills, Pa.

Whether cut-tooth or cast-tooth gears are the more economical and practicable is a matter of **conditions. We make both** 1-inch to 6-inch pitch and larger, of cast-iron, steel, or high grade semi-steel. Our neutral position and wide experience enables us to determine fairly what kind of gears to use for a given set of conditions, and we shall be glad to confer with you.

SEND US YOUR LISTS FOR PRICES

H. W. CALDWELL & SON CO.

CHICAGO—17th St. and Western Ave. BOSTON—Oliver Bldg., 141 Milk St.
NEW YORK—Fulton Bldg., Hudson Terminal, 50 Church St.

The Book of Hoists

Tells almost everything about how to lift, move and drop (gently) any heavy article. The book is yours for a postal card.

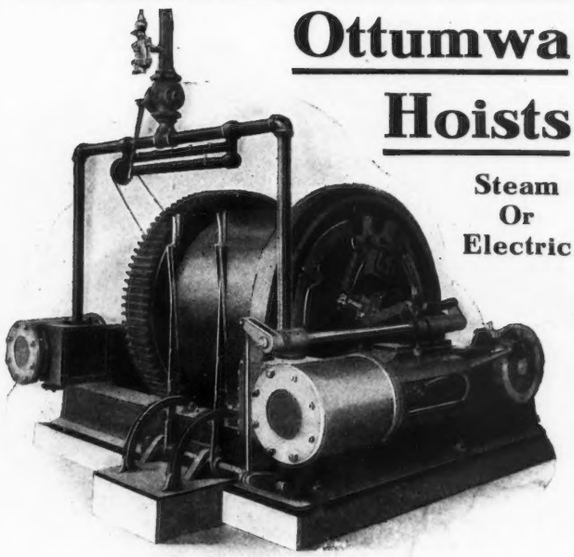
The Yale & Towne Manufacturing Company,
Only Makers of *Genuine* Yale Products,
9 Murray Street, New York City.

HOISTING ENGINES, FANS, MINE PUMPS.

ESTABLISHED 40 YEARS.
CRAWFORD & McCRIMMON COMPANY,
BRAZIL, IND., U. S. A.

Ottumwa Hoists

Steam Or Electric



Single Friction Drum Geared Hoist.

No matter what the service there is an "Ottumwa" that will meet it. Ottumwa Hoists—either steam or electric—are built in sizes up to 1000 H. P.

Write for Bulletins No. 106-107.

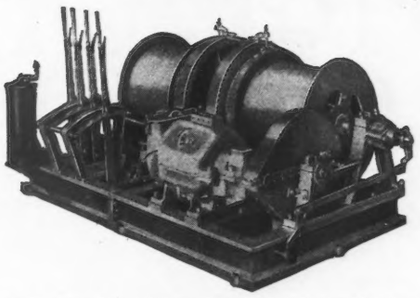
Ottumwa Iron Works,

Ottumwa, Iowa.

SALES AGENTS

The Mine & Smelter Supply Co., Denver, Colo., Salt Lake City, Utah, El Paso, Texas, Mexico City, Mex.; Harron Rickard & McCone, San Francisco, Cal., Los Angeles, Cal.; United Iron Works, Spokane, Wash.; Coeur D'Alene Hardware Co., Wallace, Idaho; Gorman, Clancey & Grindley, Calgary, Alta., Can.; Anaconda Copper Mining Co., Butte, Mont.

LIDGERWOOD MINE HOISTS



The engraving shows one of our latest style double side-by-side friction drum electric hoists **for Mines, Inclines, and Tail-Rope Haulage.** It is designed for use with a direct current of 500 or 250 volts, in sizes from 24 H. P. to 228 H. P. Hoisting capacities 2000 lbs. at 300 ft. per minute to 8000 lbs. at 750 ft. per minute. Can be equipped with Solenoid Brake if desired.

All LIDGERWOOD Hoisting Engines are built on the duplicate part system and are entirely self-contained.

STEAM AND ELECTRIC HOISTS.

Over 32,000 Engines and Electric Hoists in use Cableways, Hoisting and Conveying Devices.

SEND FOR LATEST CATALOG.

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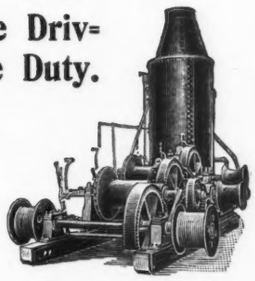
Flory Engines

For Contractors, Pile Driving, Quarry And Mine Duty.



Also tail rope haulage, inclines, slate machinery and suspension cableways.

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Satisfaction guaranteed

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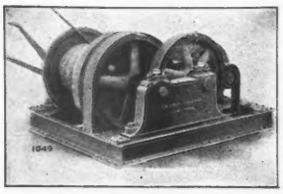

Direct Current, Any Voltage.

Alternating Current, Any Frequency.

Rope Drums from 16 inches to 5 feet in diameter.

These hoists are made in six sizes, with interchangeable parts, machine cut gear teeth, powerful brakes, with or without friction clutches, and are especially rugged in construction.

Hoists for loads of 500 to 2000 pounds carried in stock for prompt delivery. Larger sizes in stock or in process.

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New York City: 45 Broadway. Atlanta, Ga.: 607 Rhodes Bldg.
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Osborne Pneumatic Blast Separator

For separating the fines from the tailings, or screening all classes of pulverized material.

Send for circular and learn all about its wonderful capacity.

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Are You Confronted With A Difficult Ore Separating Problem?

THE WETHERILL MAGNETIC SEPARATING PROCESS

MAY PROVE THE SOLUTION.

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Manufacturing and Sales Agents for the United States.

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Manufacturers of Complete Machinery Equipments For

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Contracts Taken For The Erection Of Complete Mills

The Ideal

means of unwatering mine-shafts, flooded galleries, elevating water from one level to another, raising tailings, etc., and for all other rough service pumping about the mine, is

A Pulsometer Steam Pump

For Coal and Ore Washing or handling over and over again, without injury, liquids containing fine coal or coal dust, the Pulsometer has no equal.

Our catalog is yours. A postal will bring it.

Pulsometer Steam Pump Company
15 Battery Place, New York
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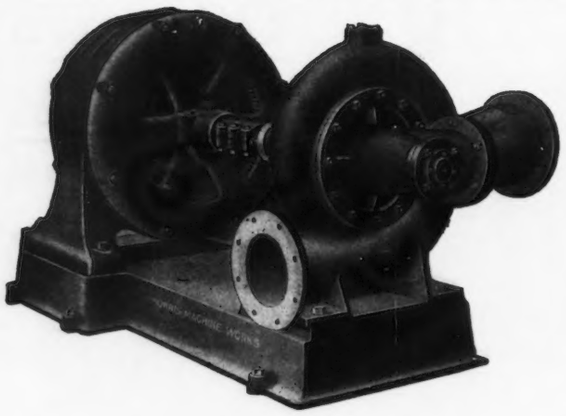

Morris Pumps

That's what Morris Centrifugal Pumps are sometimes called.

The reason is not hard to find. Their long life and ability to successfully handle water with solids in suspension has fairly won the title.

Let us send you full details.

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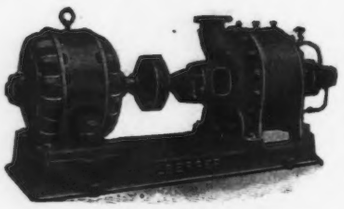
ALBERGER

High class turbine pumps for mining operations. *Write.*



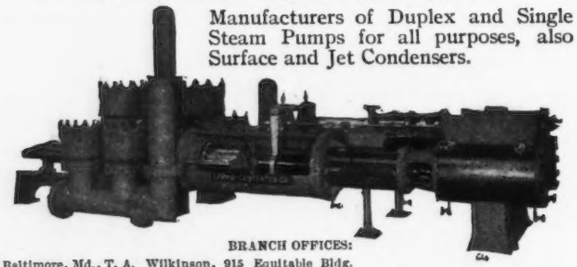
ALBERGER PUMP COMPANY

205 La Salle Street, Chicago, Ill. | 140 Cedar Street, New York | 1417-1418 Chemical Bldg., St. Louis, Mo.

Epping-Carpenter Company

Main Office and Works: Pittsburg, Pa.

Manufacturers of Duplex and Single Steam Pumps for all purposes, also Surface and Jet Condensers.



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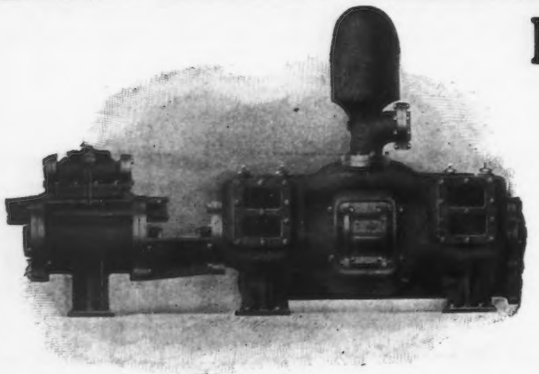

PRESCOTT MINE PUMP

for Gritty Water and Hard Service

Outside packed plungers—deep bronze-lined renewable stuffing boxes with ready access to water valves by side plates.

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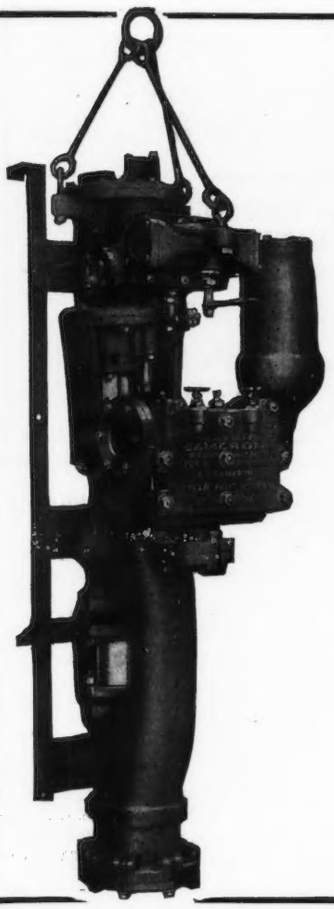
Fred. M. Prescott Steam Pump Co.
Milwaukee, Wisconsin

District Offices—El Paso, Texas—Salt Lake City, Utah. 61



The Slogan of the Cameron—"Character: The Grandest Thing"

CAMERON

VERTICAL PLUNGER SINKING PUMP

Fewer Working Parts Than Any Other Steam Pump

The Steam Mechanism, for instance! It consists of four stout pieces only. Then there's an absence of Outside Valve Gear. As the Steam Valve movement works in line with the piston rod, without the intervention of arms or levers, the Cameron can be run faster, without danger of breaking, than any other steam pump.

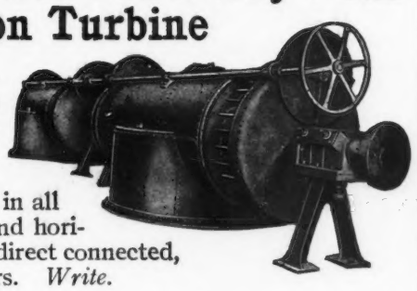
Cameron Pumps are as reliable, efficient and long-lived as 50 years' experience can make them. They are run for years and years under conditions that would knock the "cheap varieties" out in no time, and their repairs are reduced to the minimum.

New Cameron Catalog Edition "G" illustrates and describes all types of Cameron Pumps. Sent on request to interested pump users and intending purchasers.

A. S. Cameron Steam Pump Works

Foot of East Twenty-Third Street, New York 6-25-10

Make Water Power Pay With A Samson Turbine



It pays wonderfully well—you get full efficiency from it. Samson Turbines are made in all sizes, upright and horizontal, belted, direct connected, single or in pairs. *Write.*

James Leffel & Company

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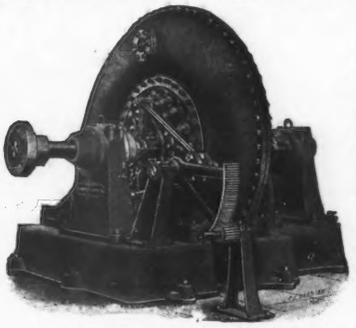
FRANCIS and McCORMICK TURBINES



Francis Horizontal Shaft Turbines of 43,000 Horsepower are now being built, to operate Six (6) generators for the Great Falls Townsite & Water Power Company, Great Falls, Mont.

Water power plants for **High** and **Low** heads designed and estimates supplied by

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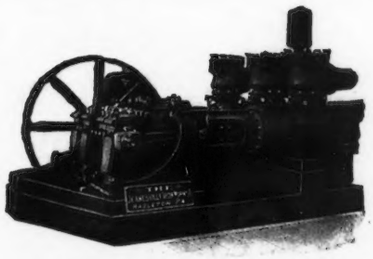

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Jeanesville Electric Pumps

For Mining Service Are In A Distinct Class By Themselves—Because

All parts are accessible.
Shafts have bearings between each two cranks.
All bearings are adjustable.
The highest efficiencies are guaranteed.
Our heavy construction is used throughout.
The construction is simple—no experts required to keep machine in order.

Jeanesville Iron Works Co.,
Hazleton, Penna.

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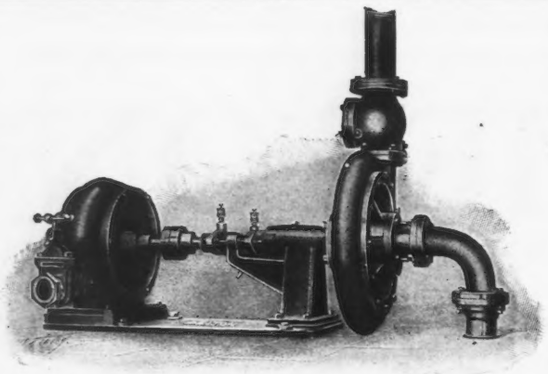
Name.....

Address.....

Jeanesville Iron Works Co., Hazleton, Penna., U.S.A.



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UNIFORM SPEED OF PELTON WHEELS ESPECIALLY ADAPTS THEM FOR PUMP, CONCENTRATOR AND DYNAMO DRIVES

SPECIAL MOTORS FOR DIRECT CONNECTION TO CYANIDE PUMPS

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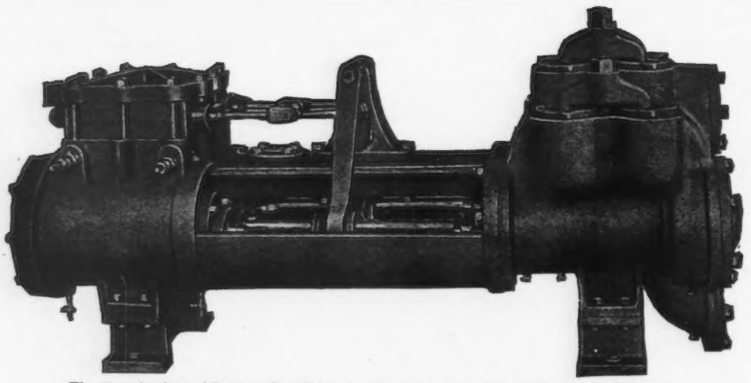

The Knowles Special Duplex "Slush" Pump. Specially designed for use in deep well drilling.

KNOWLES PUMPS

Designed for every possible variety of service. . . . . Suitable for clear, gritty, hot and cold liquids of any density or viscosity.

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KNOWLES STEAM PUMP WORKS,

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Works—East Cambridge, Mass.

DEMING TRIPLEX MINE PUMPS

Adapted for Any Power

Fig. 61.

Built in Four Types and Any Sizes

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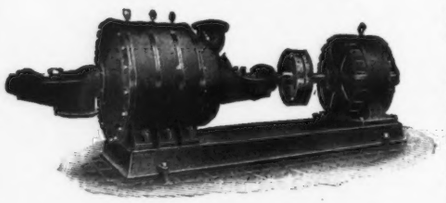
W. P. Dallet, Philadelphia. Chas. J. Jager Co., Boston. Ralph B. Carter Co., New York. L. Booth & Sons, Los Angeles. English Iron Works Co., Kansas City.

Write For Our Pump Bulletin No. 22

In it you'll find all the advantages of our pumps in detail.



Krogh Pumps

Turbine and Centrifugal are built in capacities 150 gallons per minute upward and for heads of 1000 feet or over.

Krogh Pump Mfg. Company *Write.*

149-157 Beale St., San Francisco, Cal.

Frenier's Spiral Pump

The most durable pump for elevating TAILINGS, SLIMES, BATTERY SANDS, ETC.

NO VALVES NO BUCKETS

FRENIER & SON, Rutland, Vt.

AGENTS—Allis-Chalmers Co., Chicago, Ill. Stearns-Roger Mfg. Co., Denver, Col. Harron, Rickard & McCone, San Francisco, California.

Centrifugal and Turbine Pumps

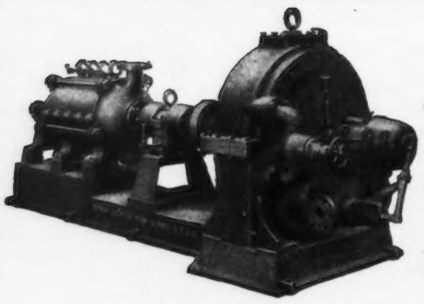
For

Mines, Irrigation, Water Works, Etc.

Each Pump Designed And Built For Its Particular Duty.

D'Olier Engineering Company

New York Philadelphia

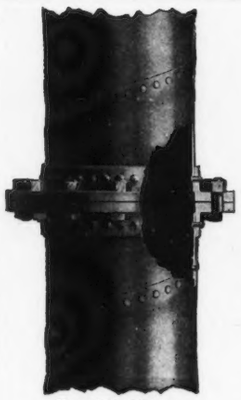


2½ Inch 5-Stage Turbine Pump and Steam Turbine

100 Gallons Per Minute. 700 Feet Lift.

Byron Jackson Iron Works, Inc.

357-361 Market St., San Francisco, Cal.



Forged Steel Flange

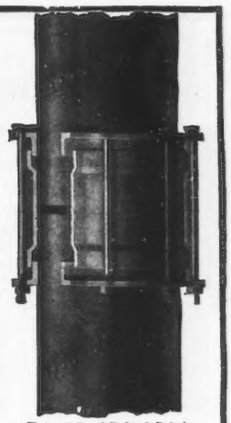
UNEQUALLED

FOR MUNICIPAL AND ALL WATER SUPPLY LINES, HYDRAULIC MINING, HYDRO-ELECTRIC POWER INTAKES, IRRIGATION AND EXHAUST STEAM PIPING.

Made from 3″ to 42″ diameter up to ¼″ thick, furnished with all steel connections, making absolutely tight joints. Easily transported and installed, Hydraulic Giants, Large Valves and Fittings. *Secure our Pamphlet No.30 H, sent on request*

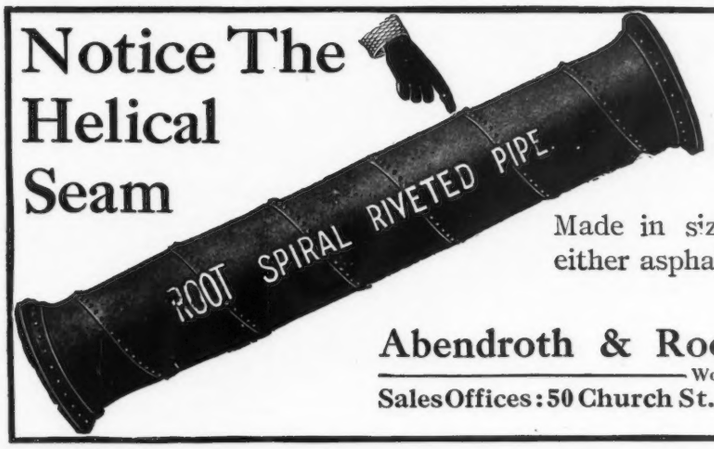
AMERICAN SPIRAL PIPE WORKS

MAIN OFFICE AND WORKS: CHICAGO NEW YORK OFFICE: 50 CHURCH STREET



Forged Steel Bolted Joint

Notice The Helical Seam



THIS is absolutely the best pipe for the long line. And for these reasons: It is lighter, stronger, more rigid and more durable, than any other pipe of equal capacity.

Made in sizes ranging from 3″ to 30″ diameter either asphalted or galvanized.

Particulars on request.

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Works: Newburgh, New York

Sales Offices: 50 Church St., New York; Commercial Bank Bldg, Chicago

THE LIGHTEST PULLEY consistent with strength.

Built to withstand the hardest service makes it practically indestructible for ordinary work.

Send for catalogue and address of nearest agent.

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Chicago Salesrooms, 32-4 South Clinton St.

Our Pipe Line

Is the strongest and best in the country.

We can make you any pipe you need—and it will satisfy your most exacting demands for quality.

Write today.

Washington Pipe and Foundry Co.

Office, Factory and Works, 3001 to 3019 Asotin St., and 1512 to 1620 Center St.

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Sent Postpaid Anywhere on Earth.

Which Catalogue Will You Have?

Tent and Camping No. 14 Guns and Ammunition No. 22
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The Wm. H. Hoegee Co., Inc.

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PORTLAND WOOD PIPE CO.

Machine Banded Continuous Stave

WOOD STAVE PIPE

Made of Oregon or Douglas Fir

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CENTRIFUGAL PUMPS
For Mines and Sinking Purposes

GRAVEL AND WATER PUMP
For Placer Mining a Specialty

CIRCULATING PUMP
Cast Iron Pipe, Tanks, Gas Producers and Iron Casting

The Risdon Gold Dredge Operates More Cheaply

than any other and produces better results without the aid of an elaborate repair plant. Every one of the exclusive Risdon features is a feature that helps to get **all** the material and **all** the gold.

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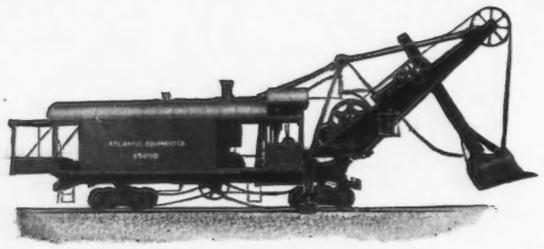
Risdon Iron Works
Hooker & Lent Bldg., cor. 1st and Market Sts.
San Francisco, California

RISDON 5¾ FT. GOLD DREDGE, Oroville, Cal.

HAVE YOU INVESTIGATED THE NEW ATLANTIC?



We are getting orders from the largest users of shovels in the country.

Actual service has demonstrated our original claims that direct wire rope hoist, simplicity of design, large boilers, cut steel gears and our especially designed car bodies and booms are the features to use. This combination is found in shovels of NO OTHER MAKE.

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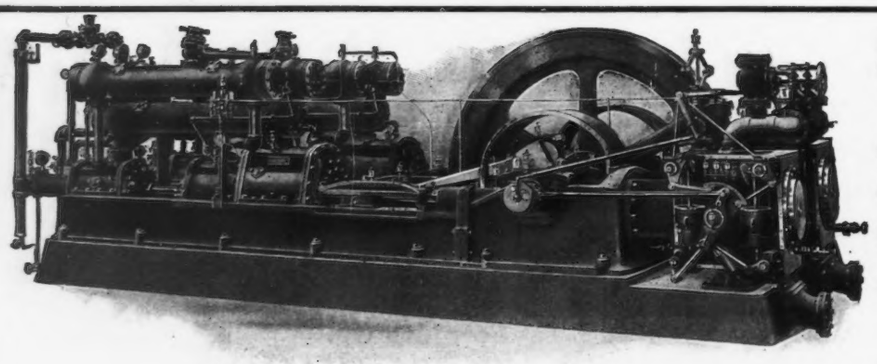

Four-Stage, High-Pressure, Twin Duplex Air Compressor

At Mines of H. C. FRICK COKE CO.

Corliss Steam Engines, automatic from nothing to full stroke.

Change Speed Governor, under air pressure control.

Dead Slow Regulator for running without load.

Automatic, Selective, Proportional Air Unloader.

1000 cubic feet. 1000 pounds air.

The Norwalk Iron Works Co.
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McKIERNAN DRILL COMPANY,

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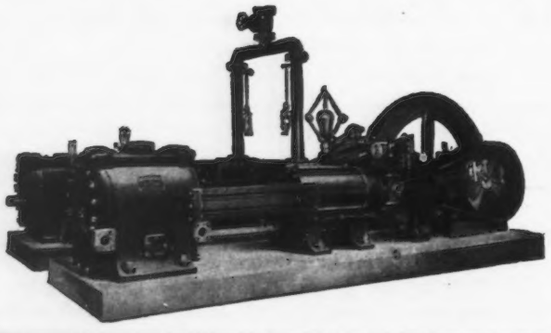
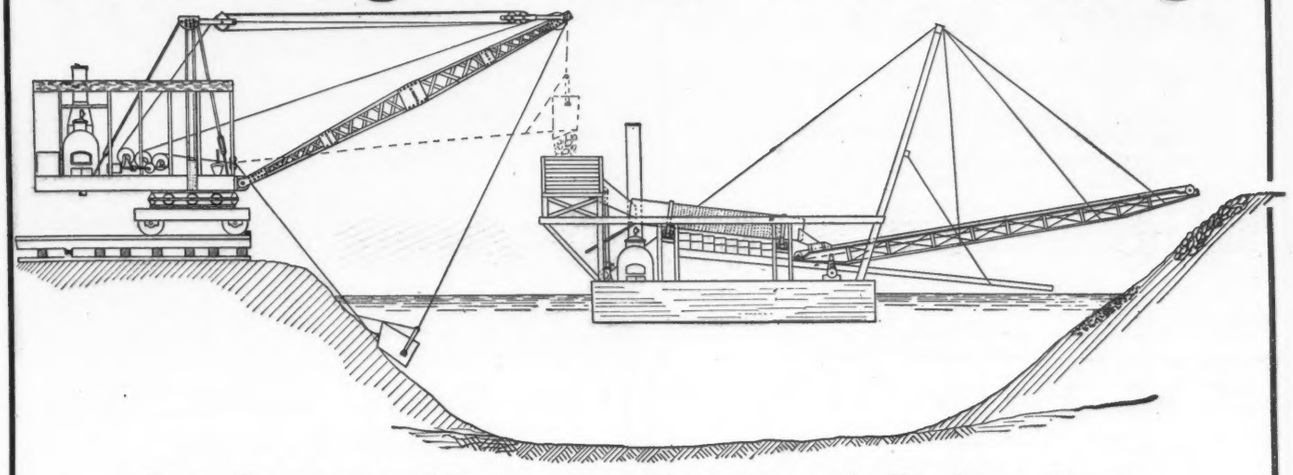


Complete Line of

AIR COMPRESSORS
ROCK DRILLS
and Appurtenances

The Drag Bucket Gold Dredge



For Operators Having Small or Rough Broken Areas

This combination is an example of the way we design equipment to meet individual conditions. It is intended for small areas where the installation of our regular California type of dredge is not justified by conditions. This design costs only half that of a bucket dredge of same capacity—its capacity is from 2000 to 2500 cubic yards per 24 hours. It can be made especially adapted for handling clayey ground. We will build you a dredge to meet your particular conditions. *Write for catalogs.*

New York Engineering Company,
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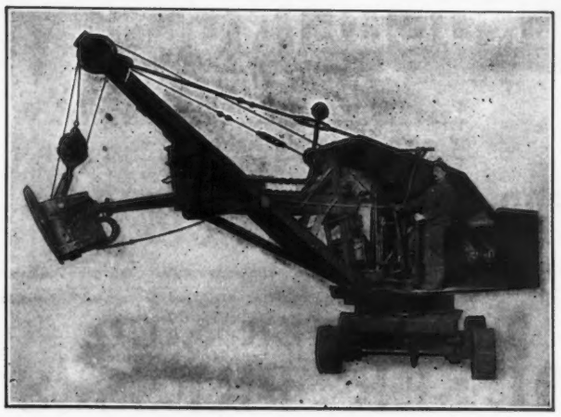
Manufacturers of Gold Dredges

THE THEW AUTOMATIC SHOVEL Co.



THE Thew Shovel is economical. It can be operated by one man doing his own firing for moderate output. Every part is made with the greatest care so that there will be the least possible expense for repairs.

Send for Catalog, it gives the details.

Lorain, Ohio, U.S.A.

Hayward Buckets Mean Decreased Digging Costs

They are adaptable to every form of digging, dredging and excavating. Their use insures speedy handling of coal, ore, broken stone, etc. Built to last—to stay at work ! It is because of the long service they give that Hayward Buckets are cheapest in ultimate cost.

Two general types—the Orange Peel and Clam Shell.

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The Hayward Company,
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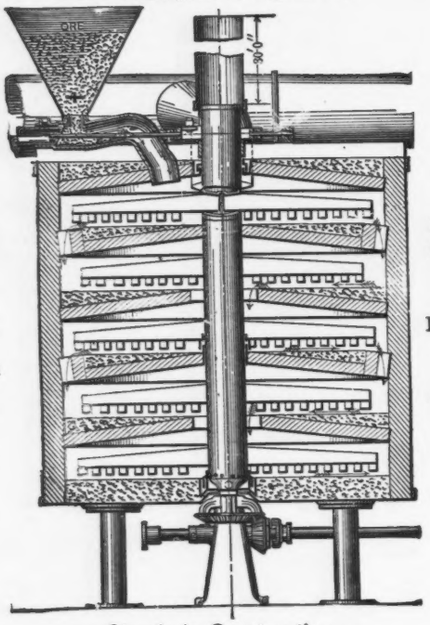
The Herreshoff Roasting Furnace

For Desulphurizing Ores



Repairs and Labor Cost Nominal.

One man can attend 100

Repairs Can be Made While Running.

No Shutting Down

Simple in Construction

No Fuel Used **Over 750 In Use**

For Further Particulars Apply To

The General Chemical Company

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1857 - FIFTY-THREE YEARS IN BUSINESS - 1910

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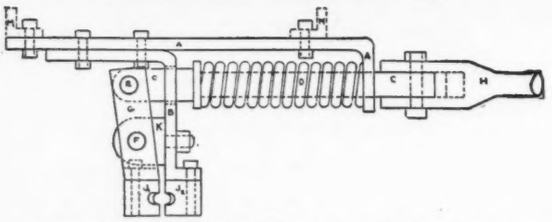
WIRE ROPE FOR MINES, QUARRIES, ELEVATORS, ETC.

AERIAL WIRE ROPE TRAMWAYS. SINGLE AND DOUBLE ROPE SYSTEMS

The Keays Cable Grip

Absolute Reliability



A reliable and efficient device for handling mining cars on the Cable Haulage System. Fully described in our booklet. Let us send it to you.

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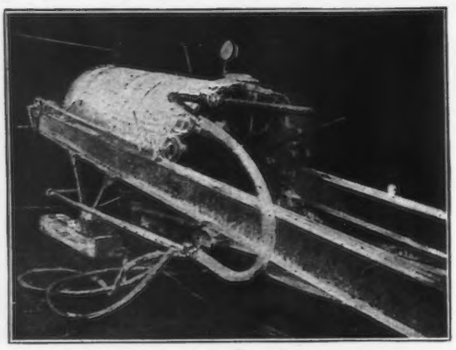

Saving in Labor **Saving in Filter Cloths**
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The Kelly Filter Press effects rapid filtration by positive pressure. It is automatic, accessible and, being made in units, is adaptable to plants of any size.

It has but one water-tight joint to take care of and thus eliminates all leakage.

We have a treatise on Filtration which gives all the *demonstrated* points of superiority. *Send for it.*

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When you want a Wire Rope why not order a

ROEBLING

There is a record of 70 years of good service back of it.

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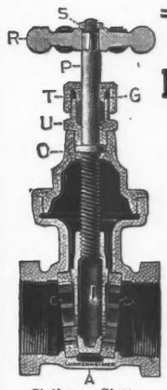

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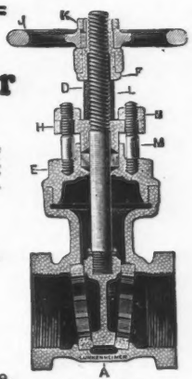

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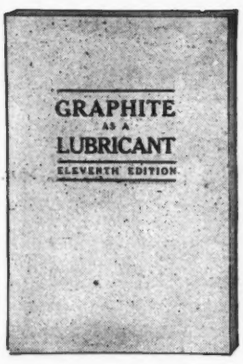

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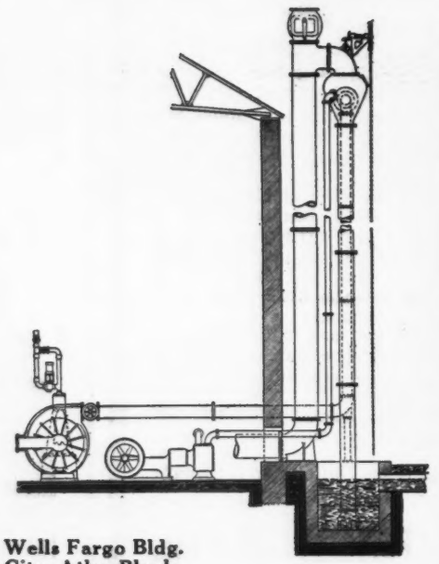

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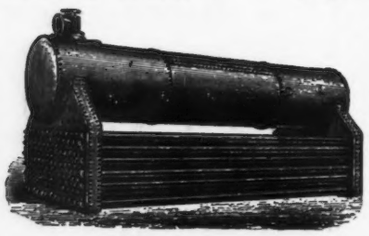

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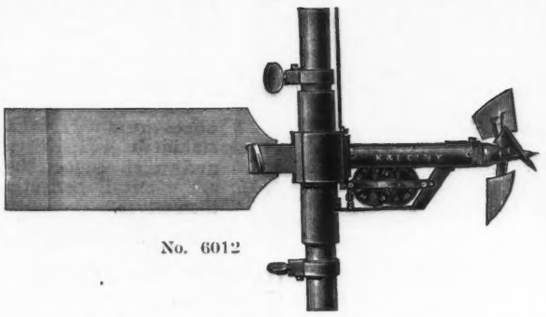

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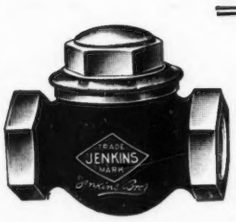

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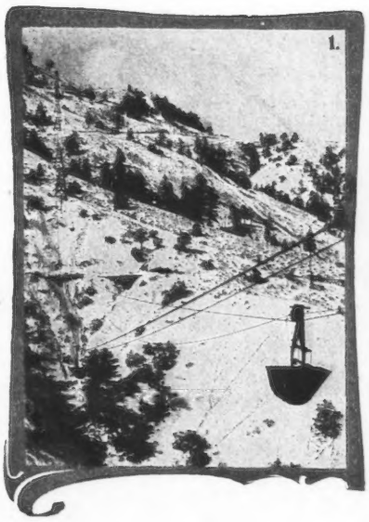

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